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No. 1

NOTES ON THE HABITS OF SOME CENTRAL AMERICAN STINGLESS BEES.¹

BY WILLIAM MORTON WHEELER.

While collecting insects in Central America during the winter of 1911-'12, I was impressed with the great diversity of behavior among the Meliponine, or stingless bees of the genus *Trigona*. Prof. Cockerell has had the kindness to study and identify the specimens I collected and as his paper appears in this number of *PSYCHE* it seemed opportune to publish my field notes at the same time. These notes comprise only such observations as I was able to make while devoting most of my attention to other insects and therefore contain little on the internal structure of the nests, which can be studied only at the expense of much time and labor. This part of the subject, however, has been ably treated by two observers in South America, Silvestri.² and H. von Ihering³ Ducke has also contributed some notes on the Brazilian Meliponinae, especially on the flowers which they visit.⁴

The observations of these authors are cited, because several of the *Trigonas* of Central America are also members of the South American stingless bee fauna.

Trigona amalthea Olivier.

A large colony of this black species was found nesting in the base of a tree near Escuintla, Guatemala. The nest was situated a few feet from the ground and had a rather convoluted, spout-shaped entrance of black wax (cerumen) projecting between two of

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 61.

² Contribuzione alla Conoscenza dei Meliponidi del Bacno del Rio de la Plata, Riv. Patol. Veget. X, 1902, pp. 121-170, 2 pls.; 19 text figs

³ Biologie der stachellosen Honigbienen Brasiliens. Zool. Jahrb. Abth. f. Syst. XIX, 1903, pp. 179-287, 13 pls., 8 text figs.

⁴ Die Stachellosen Bienen (*Melipona* Ill.) von Pará. Zool. Jahrb. Abth. f. Syst. XVII, 1902, pp. 285-328, 1 pl.)

the tree's buttresses. The colony was apparently about to swarm, as the air about the nest was full of bees flying back and forth in zig-zag paths like those described by some dancing Empidid flies. A compact mass of the insects had settled to one side of the entrance spout. On putting my tweezers into this mass I was at once enveloped in a cloud of loudly humming bees, which, however, did not settle on my body but kept darting against my face and hands, often falling over on their backs onto the ground or onto my clothing. They moved very rapidly and as if intoxicated. At the same time they emitted a distinct rancid-butter odor, like that of the ants of the genera *Tapinoma* and *Azteca*. On my moving away to a distance of about 40 feet, they all left me quite suddenly and returned to their nest.

According to Silvestri, this species may also bite, but its mandibles are feeble and innocuous. Von Ihering describes it as a "very wild" bee and as often visiting carrion, cow-dung or other excrement. He gives its native Brazilian name as "sanharó."

Trigona nigerrima Cresson.

A few specimens of this, the largest species seen, were taken on flowers in the banana plantations at Quirigua, Guatemala.

Trigona jaty F. Smith.

This small, slender, honey-yellow species is common in western Guatemala, at Escuintla and Patulul, nesting in crevices between the buttresses or bark-ridges of large trees and between the clap-boards of houses. In the latter situations it seems to prefer the corners where the clap-boards abut on the door and window frames. The nest entrance is a spout, sometimes fully an inch long but only about the diameter of a lead-pencil, either cylindrical or somewhat flattened and occasionally twisted. The wax of which this spout consists is pale yellow and as thin as paper, so that it collapses when rudely touched, especially when the temperature is high. In the early morning the bees are often seen flying in a small compact swarm just in front of the entrance, all with dangling legs and with their faces turned towards the opening. They are extremely timid and when disturbed at once retreat into the opening and cannot be induced, by poking straws, etc. into it, to come out and defend their nest. The natives of Guatemala call these little bees

which are common about the houses, "ingleses," i.e. Englishmen, "because they wear black leggings."¹

Silvestri gives a good description of the nest of *T. jaty* and says that a colony yields about $\frac{1}{4}$ litre of very sweet and aromatic honey. Both he and von Ihering, who also gives a detailed account of its nest, call attention to its very timid behavior. He records the interesting fact that it usually closes its nest spout at night with a convex waxen door, which is removed in the morning.

Trigona pallida Latreille.

This light-yellow species was common at a spot near Gatun, C. Z. on the relocated Panama R. R., where it exhibited a most extraordinary habit. At a wet ravine on one side of the track a barrel of black crude oil (with asphalt basis) had been placed as a supply for the men employed in exterminating mosquito larvæ and pupæ, and near it was a bucket which had been filled from the barrel. Perched around the rim of this bucket and crawling about the leaking spigot in the flat end of the barrel were great numbers of the bees, loading themselves with the oil! They could be seen collecting the oil with their fore legs and then transferring it to their dilated hind tibiæ. In this occupation many had succeeded in daubing their whole body, including the wings, with the sticky, strong-smelling substance, and at first sight seemed to be trying to convert themselves into pitch-black *Trigonas*. They were not, of course, really endeavoring to adopt the prevailing style of coloration among the Central American species, but were merely collecting the oil for the purpose of kneading it up with their own waxy secretions, to form the cerumen with which they build their honey pots, brood-combs and nest entrances.

Trigona cupira F. Smith.

A single colony of this black species was discovered by my wife in an orchard at Zacapa, Guatemala, nesting in the ground. The orifice, about an inch in diameter was made of clay and was arched like the door of an oven. It was guarded by a number of workers, all sitting with their faces towards the outside. When I broke into the nest with my trowel, the bees attacked me furiously,

¹ Possibly the reference is to "shoes" instead of to "leggings," since the native Guatemalans go bare-footed.

humming loudly and getting into my hair, eyebrows, moustache, eyes, ears and nostrils and biting my neck. Their jaws, however, were very feeble and the attack was far more ludicrous than disagreeable. At Guatemala City, in the bottom of one of the deep barrancas which nearly surround the town, I saw many workers of this same species collecting moist mud at the edge of a stream.

According to Ducke, *T. cupira* is common in Pará, especially on Papilionaceæ and Mimosaceæ. It works during the cooler hours of the day, i. e. in the morning and in the evening. He remarks that it has a pleasant odor like that of roses and that its honey is palatable and wholesome. Both Silvestri and Ducke maintain that it nests in trees as well as in the ground. The former saw it licking up the honey dew discharged by some Homoptera (*Ethalion reticulatum* L.) living on willows. Von Ihering gives a full description of the nest and records the native Brazilian name of this bee as "iraxim." ❧

Trigona perilampoides Cresson.

A few workers of this species were taken on flowers near Esquintla, Guatemala.

Trigona fulviventris Guérin.

Single workers were taken on flowers at Zacapa and at Puerto Barrios, Guatemala. Prof. Cockerell has sent me a specimen of this bee taken at Guatemala City by Mrs. W. P. Cockerell.

Trigona frontalis Friese.

This is a very small species, measuring scarcely more than 3 mm. in length. It was found nesting in the narrow cracks of the wooden pillars of the corridor surrounding the "patio" of a hotel at Patulul, Guatemala. Each colony comprises only a few dozen workers, which close the crack with a diaphragm of pale yellow wax and leave a round hole only 1.5-2 mm. in diameter, just large enough to permit them to enter or pass out one at a time. They are extremely timid, hastily retiring into the nest at the slightest sign of danger and remaining in it many minutes before again venturing forth. By tearing away the diaphragm with the points of my tweezers I was able to watch the bees with a pocket lens in the act of reconstructing it from the inside. This they accomplished in about 20 minutes. Again and again I tore down their

work but they rebuilt it each time, till finally, after spending some hours in this destructive employment, my patience was exhausted and I left the little creatures to enjoy their harmless and unobtrusive existence.

Trigona townsendi Cockerell.

The single specimen of this minute bee, which was submitted to Prof. Cockerell, was taken from a nest of *T. frontalis* at Patulul, Guatemala together with several workers of this latter species. It is therefore, in all probability, an inquiline, which, like so many inquilineous or parasitic bees and ants, resembles its host in size and coloration.

Trigona stigma F. Smith.

I saw a populous colony of this singular, slender bee nesting in the trunk of one of the large poisonous manzanilla trees which are common along the sea-beach at Las Sabanas, near Panama City. The entrance of the nest, which was about six feet above the ground, was a slit-shaped hole about $\frac{1}{2}$ inch long and not provided with a waxen or cerumen spout. When I discovered the nest, a compact swarm of the insects was poised in the air at the entrance, all oriented with their heads towards the hole and their long hind legs dangling. On being disturbed they made no attempt to attack me. By sweeping my hand through the swarm I could collect large numbers, but my hand became very sticky with a colorless propolis which the insects were carrying on their hind legs. A few hours later, when I again passed the tree, the swarm had disappeared. In life the slender abdomen of this bee is of a peculiar livid white color, but in dried specimens it often turns black like the remainder of the body.

Trigona bipunctata wheeleri Cockerell.

At Patulul, Guatemala, I came upon a colony of this species nesting in the trunk of a large *Acacia*. The entrance spout was made of yellowish brown cerumen. When disturbed, the bees flew at me but, to my surprise, they neither settled on nor bit my face and hands but rested amicably on my skin and clothing, till I had walked a few paces from the nest, when they all left me. This bee was frequently seen about Escuintla visiting human excrement along the railroad tracks and carrying it away for use in the manu-

facture of cerumen. At Patulul I saw it similarly engaged in large numbers in an open latrine. This, as also the similar habit of *T. ruficrus corvina* described below, raises the question as to whether some of the baneful effects recorded by South American observers as the result of eating the honey of stingless bees, may not have been due to pathogenic bacteria which had been worked by the bees into the cerumen walls of their honey pots and had contaminated their contents. At any rate, from what I have seen of this bee at Escuintla and Patulul, I have no doubt that, under certain conditions, it might become, like the house fly, a menace to public health through disseminating the germs of typhoid and other enteric diseases.

According to Silvestri, the typical *T. bipunctata* is called "tom-buna," "mandaguay," or "tapezuá" by the natives of the La Plata Basin. The spout of the nest is described as being 8-15 cm. long and 3-5 cm. broad. Von Ihering gives the native Brazilian name of this bee as "tubuna" and calls attention to its hair-twisting proclivities. He says that it often annoys people also by alighting on their skin far from the nest and imbibing their perspiration. He notices its fondness for visiting carrion and excrement and its disagreeable odor.

Trigona pectoralis Dalla Torre.

A single colony of this bee was found nesting a couple of feet from the ground in the hole of a large tree growing on the bank of a very shady ditch near Escuintla, Guatemala. The entrance had a well-defined cerumen spout about an inch long. When disturbed the bees assaulted me and buzzed about in my hair, moustache and eyebrows. They all left me as soon as I had moved about 20 feet from the nest.

Trigona pectoralis panamensis Cockerell.

At Ancon, C. Z. this species was seen visiting the yellow flowers of a great curcurbitaceous vine which covers the entrance to the Hotel Tivoli. The bees were very numerous early in the morning and seemed to prefer the wilted and partially closed flowers. By 10 a.m. they had all disappeared and did not revisit the flowers till early the next morning.

Trigona ruficrus Latreille.

While collecting along the edge of a field near Zacapa, Guatemala, I found a huge nest of this species, lying on the ground at the foot of a tree from which it had been torn. At first sight this nest resembled that of a common termite (*Eutermes ripperti*), being elliptical, nearly 2 feet long and more than a foot wide and made of a dark, dry, earthy cerumen. My attention was attracted to it by columns of large leaf-cutting ants (*Atta cephalotes*) and fire ants (*Solenopsis geminata*). On following these I found that the nest had been torn open by some of the natives and that it contained a colony of *T. ruficrus* which had been robbed of its honey. The ants were completing the ruin by imbibing the remnants of the honey and carrying off the softer and sweeter portions of the cerumen in little lumps. The defenceless bees had not deserted their abode but were vainly trying to repair the damage. They did not attempt to attack me.

Silvestri gives "irapuá" and "carabozá" as the native names of this bee in the province of Misiones. He describes and figures the structure of the nest in detail, and says that the bees bite savagely but without inflicting any pain. The honey is said to be purgative. Von Ihering gives the native Brazilian name of the insect as "irapoán." He also describes the nest in detail and states that the honey is "blackish brown, opaque, odorless, of unpleasant, nauseating, acridly sour taste, with strong acid reaction."

Trigona ruficrus corvina Cockerell.

This bee was seen near San José, Costa Rica and at Corrozal in the Canal Zone, busily collecting the sticky propolis from the surfaces of young orange leaves. But this insect is not always engaged in such cleanly work. At the garbage crematory at Gatun, C. Z. I saw it in great numbers mingling with the houseflies and blowflies inside the empty garbage barrels where it was collecting the malodorous moisture that still clung to the wooden staves. The honey of this bee, like that of *T. bipunctata*, *amalihea*, *argentata* and probably several other Central and South American *Trigonas*, may, therefore, be as unwholesome an article of human food as would be honey collected by houseflies, if these scavengers should suddenly become social and take to storing such a substance.

Trigona flaveola mediorufa Cockerell.

I found a colony of this beautiful fulvous bee at Escuintla, Guatemala, about four feet from the ground in the trunk of a large tree. There was no cerumen spout to the nest entrance which was a hole about $\frac{3}{4}$ inch in diameter, guarded by a company of workers, all with their shining yellow faces directed towards the outside. On carelessly thrusting my tweezers into the opening I was given a surprise for which my previous experiences with stingless bees had not prepared me. They rushed at my face, neck and hands in a compact swarm, emitting a scalding liquid which had the rancid-butter odor of the ants of the genus *Tapinoma*. They bit my ears and nearly blinded me by getting into my eyes, so that I had to beat a hasty retreat. Only after I had moved about 30 feet from the nest did they all leave me and return to settle down again in the nest entrance in the defensive attitude in which I had first seen them. The action of the liquid on my skin was very annoying, for all the spots on my cheeks, eyelids and hands which the bees had moistened, remained sensitive and painful to the touch for several days and in the course of the next two weeks lost their epidermis as if violently sun-burned.

T. flaveola mediorufa belongs to a group of *Trigonas* popularly known in Brazil as "cagafogos" (literally "fire-defecators") and including *T. tataira* Smith (*cacafogo* F. Müller) and the typical *flaveola* Friese. There seems to be considerable difference of opinion as to the source of the scalding liquid with which these insects so efficiently defend their nests. Von Ihering did not observe the Brazilian species *T. tataira*, but assumes from the statements of other observers "that the bee bites a small hole in the skin with its mandibles and then injects the secretion of its poison glands into this wound. In this manner arises a red spot 1 mm. in diameter, where the epidermis is lacking. It takes one or two weeks for the little wound to heal completely." Silvestri describes his experience with the typical *T. flaveola* Friese, which he calls the "cagafoga" as follows: "I came upon a nest of this species in a dead tree trunk near the River Cuyabá. On approaching it I was assaulted by a few of the bees, which bit various parts of my head. As these bites produced a slight burning sensation and as I was not provided with protective apparatus, I deemed it imprudent to expose myself to the attack of a greater number of

individuals. The burning sensation of the bite is due to the nature of the saliva, which seems to contain a great deal of formic acid; at any rate, the odor reminded me strongly of that substance "

One is, of course, hardly in a proper frame of mind during an assault of these terrible bees to make accurate observations on the source of their caustic secretion. I am convinced, nevertheless, that the liquid, of *T. flaveola* at least, comes from the posion (anal) glands and not from the mouth as Silvestri supposes, because the odor is precisely like that of the poison glands of the Dolichoderine ants (*Tapinoma*, *Azteca*, *Liometopum*, etc. and of some other insects with anal glands [Carabidæ]). The secretion is not, however, applied in the manner described by von Ihering, because the bees did not make small holes in my epidermis, but simply spread the liquid over it in considerable quantity, so that the surface was quite wet. Hence, after the attack, the cuticle was not reddened in definite small patches but was diffusely flushed over larger areas as in case of sun-burn.

MELIPONINE BEES FROM CENTRAL AMERICA.

BY T. D. A. COCKERELL.

The University of Colorado, Boulder, Colo.

When recently travelling in Central America, Dr. W. M. Wheeler collected and made observations on a number of interesting species of Meliponinae. The specimens obtained were kindly sent to me for study, and are reported on herewith.

Trigona amalthea (Olivier).

Escuintla, Guatemala, Dec. 28, 1911 (No. 2); Las Sabanas, Panama, Nov. 1911 (No. 17). This is *T. fuscipennis* Friese. The "*amalthea*" of Friese and Silvestri is *T. silvestriana* Vachal (*T. friesei* von Ihering).

Trigona nigerrima Cresson.

Quirigua, Guatemala, Nov. 1911.

Trigona jaty Smith.

Escuintla, Guatemala, Dec. 30, 1911; Patulul, Guatemala, Jan. 1, 1912.

Trigona pallida (Latreille).

Gatun, Panama, Canal Zone, Nov. 11, 1911; Las Sabanas, Panama, Nov. 1911.

Trigona cupira Smith.

Guatemala City, Guatemala, Dec. 1911; Zacapa, Guatemala, Dec. 15, 1911 (No. 10). A male from San José, Costa Rica, Dec. 27, 1911 (No. 8) evidently belongs here; it has a narrower face than the female, and the clypeal markings are obscure.

Trigona perilampoides Cresson.

Escuintla, Guatemala, Dec. 28, 1911.

Trigona fulviventrís Guérin.

Zacapa and Puerto Barrios, Guatemala.

Trigona townsendi Cockerell.

Patulul, Guatemala, Jan. 2, 1912, one specimen (No. 19). This

minute species has hitherto been known only from Peru. Face all black.

Trigona frontalis Friese.

Patulul, Guatemala, Jan. 2, 1912, one specimen. Face-markings, white.

Trigona stigma Smith.

Las Sabanas, Panama, Nov. 1911 (Nov. 14). In several specimens the abdomen is yellowish white except at apex; in others dark brown. This is, I believe, due to immaturity. A specimen from Sangre Grande, Trinidad, March 16, 1912 (*H. Scott*) is considered to be the hitherto unknown male of this species. It is like the worker, but with longer antennæ, and the anterior orbits are very narrowly margined with creamy-white. Dr. Friese, to whom a specimen of this species was submitted, considered it undescribed, but it agrees exactly with Smith's description of *stigma*.

Trigona bipunctata wheeleri subsp. nov.

Worker. Smaller, length hardly $4\frac{1}{2}$ mm.; wings suffused with orange ferruginous, the color especially bright and strong in the costal region. Known from other black Guatemalan species by the color of the wings, a variable light spot at each side of the clypeus, and the upper part of the clypeus with a variably distinct keel. The mandibles are bright red at apex. *T. bilineata* Say, from the Rio Nautla, Mexico (*Townsend*) is hardly to be considered a distinct species, but it has not the orange wings, and does not closely resemble the present insect.

The new form is from Escuintla, Guatemala (type locality), Dec. 20, 1911 (No. 11); Patulul, Guatemala, Jan. 8, 1912. Twelve specimens in all.

Dr. Friese, who examined a specimen of this species, referred it to *T. mexicana* Guérin. I have what I consider to be *T. mexicana* from the Rio Nautla, Mexico (*Townsend*); it has greyish-hyaline wings, and is distinct from the present insect.

Trigona pectoralis (Dalla Torre).

Escuintla, Guatemala, Dec. 27, 1911 (No. 5). Professor C. F. Baker sent me specimens of this species from San Marcos, Nicaragua, labelled *T. dorsalis* Sm., det. Friese. I have a true *dorsalis* from F. Smith's collection; it has a long abdomen, and is evidently distinct from *pectoralis*.

Trigona pectoralis panamensis subsp. nov.

Worker with the long pollen-collecting hairs of hind tibiae all black (in typical *pectoralis* they are entirely pale red).

Las Sabanas, Panama, Nov. 1911, two workers (No. 15).

Trigona n. sp.(?).

Gatun, Panama, Canal Zone, Nov. 11, 1911. A worker in very bad condition; resembles *T. fulviventris* Guér., but the legs are red, and the hair of head, thorax and legs is entirely fulvous; the mesopleura is also evidently red. So far as can be made out the species is new, but it cannot be described properly without fresh material.

Trigona ruficrus (Latreille).

Zacapa, Guatemala, Dec. 13, 1911.

Trigona ruficrus corvina subsp. nov.

Worker with hind tibiae and tarsi black. Larger than *T. amalthea*; wings very dark; mandibles red.

Zacapa, Guatemala (type locality), Dec. 12, 1911 (No. 3); San José, Costa Rica, Dec. 27, 1911; Gatun, Panama, Canal Zone, Nov. 11, 1911 (No. 7.); Las Sabanas, Panama. Dr. Friese would not separate this from *T. fuscipennis*, but it has red mandibles, and in my opinion belongs with *ruficrus* rather than with *amalthea* (*fuscipennis*).

Trigona nigra Cresson = *cressonii* Dalla Torre.

This is not in Dr. Wheeler's collection, but I take the opportunity to note that specimens from Belize, sent by Prof. C. F. Baker, are labelled *T. hyalinata* Lep., det. Friese.¹ It is however plain from Lepeletier's description that they cannot be that species.

Trigona flaveola mediorufa subsp. nov.

Worker. Length about $5\frac{1}{2}$ mm.; orange-ferruginous and black; head extremely large, broader than thorax, pale ferruginous, the face suffusedly light yellowish-testaceous; ocellar region black, the black variable in amount, with or without lateral processes; clypeus with a transverse black subapical line; front and face almost hairless, front brilliantly shining, face (with clypeus) finely sculptured with

¹Professor Baker's species labels were large, and I replaced them by smaller ones. I do not now recall whether "det Friese" was on the original labels, or was placed there by me on the basis of information sent separately.

quite dense microscopical punctures; mandibles pale reddish testaceous, with a black basal tubercle, the margin dentate only at the inner corner; scape pale ferruginous, with the apical part darkened; flagellum dark with the apical margins of the joints ferruginous beneath; mesothorax moderately shining, with rather coarse and abundant hair, which is red on the red parts, but mainly fuscous on the back; middle third of mesothorax (broader behind) clear ferruginous, lateral third black, but the lateral margins narrowly ferruginous; scutellum ferruginous with a dark basal spot; pleura and metathorax black, with partly reddish and partly fuscous hair (fuscous in front and beneath); prothorax orange-ferruginous with a black stripe on each side; tubercles ferruginous; tegulæ large, pale yellowish red; wings hyaline, yellowish basally, stigma and nervures light orange-ferruginous; legs reddish-black, with the following parts red or yellowish-red, anterior femora in front, and apically behind, with more or less of a stripe down lower side, anterior tibiæ in front and a broad stripe down outer side, apices of the tarsi, middle and hind trochanters above, and spot at apex of middle femora; hairs of the not greatly broadened hind tibiæ black; abdomen rather short and narrow, shining clear orange-ferruginous, the apical segments with coarse hair, which appears black in some lights and reddish in others, but that of last segment always appears red; hair on inner side of basitarsi red, shining, brilliant red-golden.

Hab.—Escuintla, Guatemala, three taken Dec. 30, 1911. (*W. M. Wheeler*, 30). Not very close to any species known to me by specimens or descriptions, but it may be compared with *T. tataira* Smith (*coccofago* H. Müller; *cacafago* F. Müller), from which it differs by the much broader face, much longer scape, color of the legs, etc., (a cotype of *tataira* compared). Since writing the above, I have been informed that Dr. Friese considers this to be his *T. flaveola*. As however *flaveola* was described as “ut *cacafago*, sed thorace ferrugineo, femoribus ferrugineis; alis hyalinis, basi fuscata, pterostigmate flavido, cellula radiali hyalina.” I think I am justified in considering our insect at least subspecifically distinct.

The following table will facilitate the separation of the species discussed above:

Mesothorax and scutellum densely rugosopunctate; axillæ pale, as also the bidentate apex of scutellum.....	<i>perilampoides</i> Cress.
Not thus sculptured and marked.....	1
1. Wings blackish, with the apex white; small black species.....	<i>cressoni</i> (D.T.)
Wings not thus colored.....	2
2. Minute, length 4 mm. or less.....	3
Larger, over 4 mm.....	4
3. Larger; face with white markings.....	<i>frontalis</i> Friese
Smaller; face all black.....	<i>townsendi</i> Ckil

4. Legs bright ferruginous.....5
 Legs mainly (*mediorufa*) or wholly black or brown, dark.....7
5. Mesothorax wholly red.....*pallida* (Latr.)
 Mesothorax black, or almost entirely so.....6
6. Hind tibiae with hair all red.....*pectoralis* (D. T.)
 Hind tibiae with conspicuous black hairs.....*pectoralis panamensis* Ckll
7. Head and thorax black; abdomen orange; wings dusky reddish..*fulviventris* Guér.
 Not so colored.....8
8. Wings with bright ferruginous costa.....9
 Wings without red costa.....10
9. Abdomen orange-ferruginous; head very large.....*flaveola mediorufa* Ckll
 Abdomen black.....*bipunctata wheeleri* Ckll
10. Wings white or clear hyaline, stigma light ferruginous; abdomen long and
 narrow, often pale.....*stigma* Smith
 Wings dark or dusky; abdomen ordinary.....11
11. Large; anterior wing about 9.5 mm. long.....*nigerrima* Cress.
 Smaller.....12
12. Face broad, without light markings.....13
 Face with light markings.....*cupira* Smith
13. Mandibles dark.....*amalthaea* (Oliv.)
 Mandibles red.....14
14. Hind tibiae and tarsi red.....*ruficrus* (Latr.)
 Hind tibiae and tarsi black.....*ruficrus corvina* Ckll

MALLOPHAGA FROM BRAZILIAN BIRDS.¹

BY JOHN H. PAINE AND WILLIAM M. MANN.

We have recently received from Dr. E. Snethlage, director of the Division of Zoölogy at the Museu Goeldi at Pará, the small, but very interesting collection of Brazilian Mallophaga listed herewith. The specimens were taken by Dr. Snethlage from birds collected by her. The identifications of the birds are from the same source.

Goniocotes verrucosus Taschenberg. (Fig. 1).

Two specimens, male and female, of this curious form from *Crypturus tataupa* Temm. (Marajo, Brazil. Nov. 1911). So far as we know, this is the first record of the female of this species. It is considerably larger than the male, especially as regards the length of abdomen. Peculiar to this species are the curious, dark, semi-circular scales, attached to the dorsal surface of the insect by their lateral edges, and arranged in double and single rows on the thorax and abdomen. (Fig. 1b). We figure the female, in outline, Taschenberg's figure of the male being rather indefinite and lacking in detail.

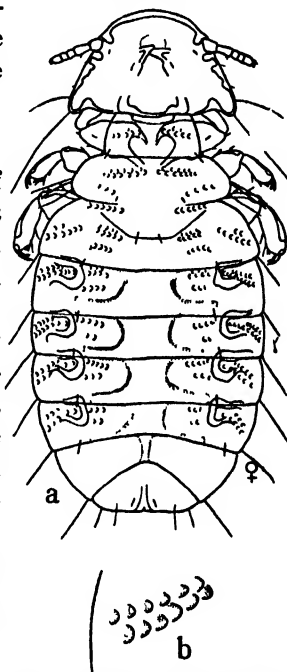


Fig. 1. *Goniocotes verrucosus* Tasch.

Measurements.

Length: ♀, 1.34		Width:	
Head	.29		.42
Thorax	.24		.42
Abdomen	.86		.62

Goniodes complanatus Piaget.

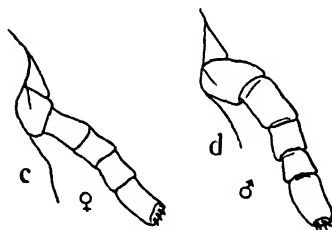
Nine specimens, male and female, from *Crypturus tataupa* Temm. (Marajo, Brazil, Nov. 1911). The head of this species

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 64.

bears a close resemblance to certain members of the genus *Nirmus*. The lobes of the last segment of the abdomen in the female do not appear so prominent as in Piaget's figure.¹

Goniodes coniceps Taschenberg. (Fig. 2).

Two male and seven females from *Crypturus tataupa* Temm. (Marajo, Brazil, Nov. 1911). This is apparently the first record



of the female of this species. It is larger than the male, which however, is considerably smaller than the type of the species. The first segment of the antenna of the female is somewhat shorter than that of the male (Fig. 2, c-d); the abdomen is also much broader. We also figure the last segments of the male (Fig. 2b).

Measurements.

♀, length: 1.56		Width:
Head	.46	.60
Thorax	.28	.60
Abdomen	.90	.80
♂, length: 1.40		Width:
Head	.42	.58
Thorax	.27	.57
Abdomen	.80	.72

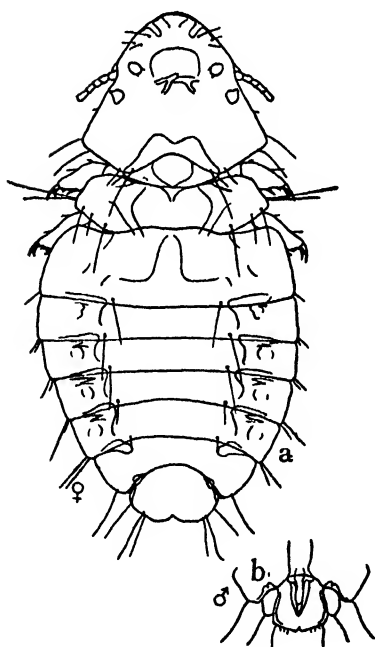


Fig. 2. *Goniodes coniceps* Piaget.

Goniodes pennaticeps sp. nov. (Fig. 3).

One male specimen from *Anthus lutescens* Puch. (Marajo, Brazil, Nov. 1911). This species belongs to the group of *G. laticeps* Piaget and of *G. aliceps* Nitzsch, closely resembling the latter, but differing strikingly in size, the present species being less than

¹ Piaget, E. Les Pédiculines, II, Pl. XXI, fig. 8. (1880).

half as long. Carriker¹ lists and figures a form under the name of *G. laticeps* Piaget which, from his figure, is apparently *G. aliceps* Nitzsch.

Description of male: Head broadly conical, broader than long, with rounded front; three minute hairs on the clypeus on each side and two more prominent pustulated ones on the dorsal surface near the center. Notch for the reception of the antennæ distinct but not deep; antennæ situated well forward, with first segment longest and broadest; second segment longer than those following, fourth shortest and third and last of about equal length; last segment truncate. Antennal bands prominent, extending from margin before the antennæ in to the mandibles; dark chestnut in color except midway between margin and mandibles where they are blackish. A large, oval space, light in color, before the mandibles, with a small crescent shaped signature near the center. Eye large, slightly protruding, with a small hair at its posterior margin; a rounded ocular blotch in front of the eye; also a similar one behind the eye formed by the termination of the broad marginal band of the temple; a prominent pustulated hair on the dorsal surface near the anterior ocular blotch. Temples highly divergent with margin straight, bearing two short hairs; posterior angle acute, with one very long hair and a small one; the broad temples are characteristic to this group of *Goniodes*. Posterior margin long and sinuous with central concavity very deep; margin on either side of the central concavity broadly rounded with two long hairs reaching well back on the metathorax; occipital bands prominent, dark in color with black occipital blotches; bands divergent, extending forward and fading out opposite the posterior projections of the mandibles; a prominent postulated hair on the dorsal surface, close to the inner edge of each occipital blotch.

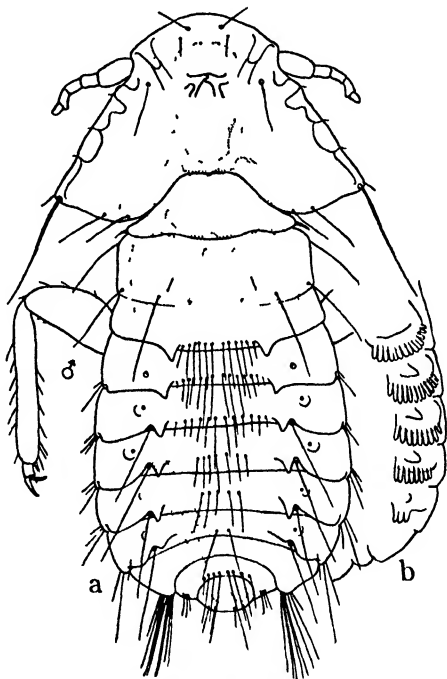


Fig. 3. *Goniodes pennaticeps* Paine and Mann.

bearing two short hairs; posterior angle acute, with one very long hair and a small one; the broad temples are characteristic to this group of *Goniodes*. Posterior margin long and sinuous with central concavity very deep; margin on either side of the central concavity broadly rounded with two long hairs reaching well back on the metathorax; occipital bands prominent, dark in color with black occipital blotches; bands divergent, extending forward and fading out opposite the posterior projections of the mandibles; a prominent postulated hair on the dorsal surface, close to the inner edge of each occipital blotch.

¹ Carriker, M. A. Mallophaga from birds of Costa Rica, Central America. Univ. Studies, Univ. of Neb., Vol. III, No. 2 p. 35. (April, 1903).

Thorax shorter than head. Prothorax trapezoidal, with divergent sides and blackish submarginal bands; these bands turn inward and downward before they reach the prominent, acutely projecting posterior lateral angles, forming the first intercoxal bands; a short, heavy spine on these posterior lateral angles and another smaller one a short distance above on the lateral margin; posterior margin slightly sinuous.

Metathorax wider than prothorax, quadrilateral, with rounded angles; two long, prominent, submarginal hairs a little below the anterior angles, and another in each posterior angle. Dark chestnut to blackish submarginal bands, connecting with those of the prothorax and turning in along the posterior margin of the metathorax to form the second intercoxal bands. Posterior margin straight for about one-third its length on each side, at which point, where a long, pustulated hair arises, it becomes faint, turning downward at an angle of about thirty degrees and fading out completely before it reaches the meson. There are two small, pustulated hairs on the dorsal surface above, and a little inward from those on the posterior margin. Posterior legs with peculiarly long, straight tibiae bearing numerous spines; the mesothoracic legs have been broken off; the anterior ones are short, being carried concealed under the broad temples.

Abdomen considerably narrower than the head, obovate, with sides straight and slightly divergent until the widest point is reached at the fourth segment, whereupon they round off gradually to the eighth; eighth segment short, not reaching as far posteriorly as the seventh or ninth; ninth segment rounded and protruding. Prominent, bipartite, lamelliform plates or appendages on the dorsal surface of each segment from the first to the sixth, extending inward from the lateral margin; inner portion a narrow, pointed appendage, separated from the lateral, linear portion by a deep sinus, embracing a long pustulated hair; in Taschenberg's¹ figure of *G. aliceps* Nitzsch, these plates are lacking on segment one; this, however, may be due to a mistake by the artist. Corresponding to these plates, in position, on the ventral surface of segments two to six are the characteristic series of dark colored, blunt, comb-like spines (Fig. 9b); the number of spines on each segment agrees with *G. laticeps* Piaget, diminishing from fifteen on each side of the second segment to three on each side of the sixth; the number, however, as noted by Taschenberg, is slightly variable; broad, darkish, lateral bands cover the region of the combs and lateral section of the dorsal plates. In length segment one is the shortest, with slightly diverging sides, not appearing as a part of the thorax as in the case of *G. laticeps* Piaget; segment two the longest, the following segments diminishing in length to the fifth, and then increasing slightly to the seventh; a series of pustulated hairs across the middle of each segment, stopping before the lateral appendages are reached; also hairs in the posterior lateral angles of each segment, and segment seven bearing a group of about ten very long ones on the ventral surface. Genitalia similar to *G. aliceps*, being composed for the most part of two long, narrow, chitinous rods.

¹ Taschenberg, O. Die Mallophagen. Nov. Act. Kais. Leop. Carol.-Deutschen Akad. Naturforsch. Bd. XLIV, Nr. 1. Tab. 1, fig. 5. (1882).

Measurements.

Length: ♂, 2.34		Width
Head	.76	1.24
Prothorax	.30	.70
Metathorax	.33	.80
Abdomen	1.24	1.04

It is indeed strange to find *Goniodes* as a parasite of *Anthus*, a member of the family *Motacillidæ*, the Wagtails and Pipits, when it properly belongs with the *Gallinæ* and the *Phasiani* and such fowl-like birds. *G. aliceps* Nitzsch was taken from *Crypturus macrurus* and *C. tao*, and *G. laticeps* Piaget, from *Tinamus julius* and *T. robustus*. These facts cause one to be somewhat skeptical as to the validity of the present record.

Menopon exsanguis sp. nov. (Fig. 4.)

Six specimens, including two males, from a woodpecker, *Campophilis melanoleucus* Gm. (Rio Nhamunda, Brazil. Jan. 1912). Two species of *Menopon* have previously been described from woodpeckers, *M. pici* Denny¹ from *Picus viridis* (Great Britain), and *M. praecursor* Kellogg² from *Melanerpes uropygialis* (Baja California). The present species quite closely resembles *M. pici* Denny, as described by Piaget,³ but differs in a number of characters, being much smaller in size, with palpi projecting by but one segment or less. Also, in *M. exsanguis*, the eye is very large and somewhat irregular, extending from the inner termination of the ocular emargination, back on the dorsal surface of the temple half way to the posterior margin and not reaching the lateral margin of the head at any point. General color pale, with darker, indefinite markings on the head and thorax.

Description of female: Head much broader than long, with front flatly rounded or slightly angled, outline of head appearing triangular. A short hair on each side, on the clypeus, a short distance from the center; another, of about the same size, at the point where the palpi pass the margin and two more very minute ones between the two above mentioned; three long hairs at short, regular intervals, before the ocular emarginations; also a long hair on the dorsal surface, on each side, on a line between the ocular emarginations and the mandibles. Emarginations narrow, not deep, with a fringe of about ten short hairs. Eyes as described above, with a

¹ Denny, Monograph, Anoplur. Brit. p. 219, pl. XX, fig. 5. 1842.

² Kellogg, V. L. New Mallophaga III. Occ. Papers California Acad. Sci. VI. p. 46, pl. IV, fig. 8. 1899.

³ Piaget, E. Les Pédiculines, Supplément, p. 93, p. X, fig. 3. 1885.

large, black ocular fleck. Ocular blotches present, but pale and indefinite. Temples protruding, narrowly but regularly rounded, with six long hairs, one of which arises submarginally; also several short ones. Occiput broadly concave, with six long, submarginal hairs; Margin thickened, but little colored. Entire head rather pale yellow, with the exception of the mandibles, an area surrounding them, and the indefinite ocular blotches. Antennæ differing from those in *M. pici* Denny, the third segment being larger and goblet-shaped, receiving the last. (Fig. 4b).

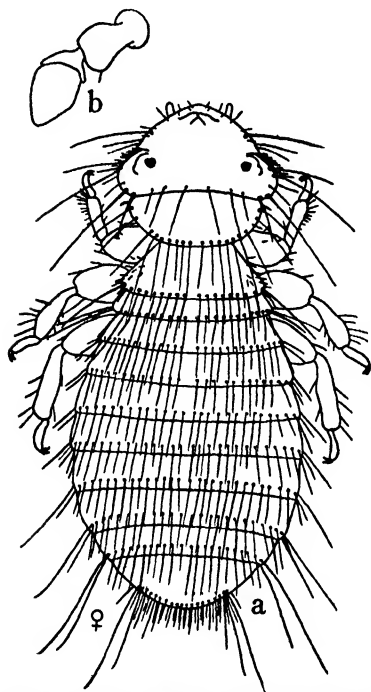


Fig. 4. *Menopon exsanguis* Paine and Mann.

Thorax slightly longer and narrower than head, with more, darker coloring. Prothorax with rounded sides merging into the flattened, almost straight, posterior margin; anterior angles rounded. A series of eighteen long hairs, with several short ones, extends around the sides and posterior margin. Lateral bands present, their inner margin indefinite. Metathorax about the same length as the prothorax, but wider, trapezoidal, with indefinite posterior margin. A number of short marginal and submarginal spines on the divergent sides, toward the acute posterior angles; two long hairs on this angle and a transverse series of about fourteen long hairs indicating the position of the posterior margin. Legs rather short, with broad, stout femora.

Abdomen elliptical, truncate where it joins broadly with the thorax, widest at the fifth segment; pale in color, with almost transparent margins. Segments of nearly equal length, with a transverse row of from twenty to thirty strong hairs. Last segment rounded, but somewhat triangular in shape, with about twenty hairs around the margin, the anterior ones of which are quite long; on the ventral surface are two fringes of fine hairs.

Male varying in size, the largest one being but little smaller than the female. Last segment similar in shape to that of the female, but with fewer hairs and lacking the ventral fringes. Genitalia prominent, consisting of a broad anterior portion and long, slender lateral appendages.

Measurements.

♀, Length: 2.50	Width: .84	♂, Length: 2.36.	Width: .82
Head .46	.84	.46	.82
Prothorax .32	.65	.30	.64
Metathorax .24	.76	.24	.73
Abdomen 1.60	1.14	1.42	1.12

Physostomum sucinaceum Kellogg.

Two specimens, one immature, from *Elænia flavogaster* Thunb. (Marajo, Brazil, Nov. 1911).

Trochilæcetes gen. nov.

In general habit resembling *Physostomum*, except that the sides of the head are deeply emarginate. These lateral emarginations give the head a constricted appearance, the anterior portion forming the somewhat rectangular clypeus and the posterior portion comprising the temples and occiput; temples not produced backward; palettes present. Prothorax more rounded than in *Physostomum*, with the posterior margin convex. Metathorax showing no sign of a mesothoracic suture, broad, appearing as the first abdominal segment. Abdomen elliptical, with two pale, submarginal bands, as in *Physostomum*; last segment rounded. The members of this genus are peculiar to humming-birds, the three known species, which are closely related, having been taken from these hosts. The type of the genus is *Physostomum prominens* Kellogg and Chapman.

*Included Species.**Trochilæcetes prominens* Kellogg and Chapman.

Physostomum prominens Kellogg and Chapman, New Mallophaga. III. Occ. Papers California Acad. Sci. VI. p. 137. (1899).

From *Calypte costæ*, Costa's Humming-bird (Ontario, California).

Trochilæcetes doratophorum Carriker.

Physostomum doratophorum Carriker, Univ. Studies, Nebraska, Vol. III., No. 2, p. 43. (1903).

From *Selasphorus flammula* (Volcano Irazu, Costa Rica).

Trochilæcetes emeliæ sp. nov. (Fig. 5).

A single female specimen from *Thalurania furcatoides* Gould (Obidos, Brazil, Feb. 1912). This species closely resembles *T. doratophorum* Carriker, but is much smaller in size, measuring 2.10 mm. long and .86 mm. wide, while the latter species measures 2.41 mm. in length by 1.10 mm. in width. The present species also differs in the shape of the head, having larger temples.

Description of female: Head slightly broader than long, being greatest in width across the temples; front broad, shovel shaped, with clypeus but little concave; pale in color across the anterior margin; anterior angles rounded, and sides of front slightly convex with narrow marginal band a little darker than general color of

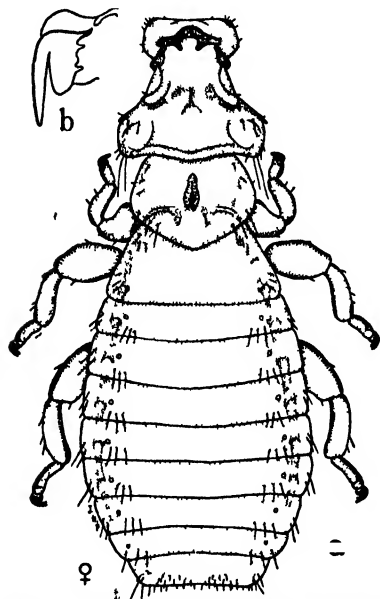


Fig. 5. *Trichilacetes emelin* Paine and Mann and several short spines. Occiput sinuous, bare, with a marginal band. The

palettes, in the specimen in hand, have been partially torn away or are quite small though we are inclined to believe that the former is true; the portion present rather darkly colored. Palpi small, not projecting beyond the sides of the head.

Prothorax subpentagonal, rounded; posterior margin strongly convex, with a rounded median angle, three strong hairs and one spine toward the lateral angles; above these angles, one marginal and three submarginal spines; a light colored submarginal band, continuous with that of the abdomen. Metathorax appearing as the first abdominal segment, with submarginal bands, continuous with those of the abdomen and prothorax and giving off a short branch, running inward along the posterior margin of the prothorax, stopping short of the meson. The metathorax extends under the prothorax for a considerable distance and gives rise to a median, chitinous, spear-shaped thickening which shows plainly through the prothorax. There are several submarginal spines, both in the anterior and posterior lateral angles; posterior margin straight. Legs stout, light in color, with narrow, marginal bands and curious, heavy, staple shaped claws. (Fig. 5b).

Abdomen, including metathorax, elliptical, narrower than in *T. doratophorum* Carriker, with the submarginal bands nearer the margins, the bands disappearing

front, which is pale; also a narrow darker band across the front, a little back from the clypeal margin, with a pair of backward converging projections, one on each side of the meson. Two extremely minute hairs on the margin of the clypeus; two longer ones on the dorsal surface in the anterior lateral angles and two more on the margin at this point, also several on the ventral surface; another short hair on the lateral frontal margin, a little behind those mentioned and two more on the angle just before the deep lateral emargination; a chitinous band, but little darker than the ground color of the insect, extends around the emarginations. A small well-defined triangular projection, directed outward and backward, on the margin at the beginning of the temples, and in front of this a small hair; temples rather prominent with the anterior angle weaker than the posterior, the latter bearing two rather long hairs

in the sixth segment; faint, transverse bands, leaving the sutures indefinitely lighter. There are no median hairs, but several long ones on each side near the submarginal bands; last segment entire, truncate or very slightly concave, with sides rounded; a row of short hairs across the posterior margin of the last segment, and a group of strong, close-set hairs on each side on the ventral surface.

Measurements.

Length: ♀, 2.10	Width:
Head .52	.56
Prothorax .92	.42
Metathorax .32	.64
Abdomen 1.06	.84

Named in honor of the collector, Dr. Emelia Snethlage of the Museu Goeldi at Pará.

A NEW GENUS AND THREE NEW SPECIES OF PHORIDÆ
FROM NORTH AMERICA, WITH NOTES ON TWO
RECENTLY ERECTED GENERA (*CREPIDOPACHYS*
AND *PRONOMIOPHORA* ENDERLEIN).

BY J. R. MALLOCH,

Bureau of Entomology, U. S. Department of Agriculture.

Dr. G. Enderlein in describing (Stettiner entom. Zeit., 1912, p. 16) some Phoridæ from southern Brazil erected the genus *Crepidopachys* with the new species *longirostrata* as type. The legend to the figure on same page, which is presumably that of the wing of this species, indicates that it is *C. costalis*, Enderlein. Thus *costalis* is evidently a synonym of *longirostrata* Enderlein. In his remarks on the affinities of the genus he indicates that it differs from *Pronomiophora*, Enderlein, 1912, in having the costa thickened. This latter genus is not described prior to the former but at page 46 of the same publication, and therefore ought to be considered as erected on page 16, and on page 46 appear as *Pronomiophora* Enderlein and not "nov. gen." Independent of these trifling errors however I fear that there are some others which are of much more consequence. From the description I am forced to the conclusion that in erecting *Crepidopachys* and *Pronomiophora* Enderlein added two quite unnecessary genera inasmuch as both

are quite evidently synonyms of *Dohrniphora* Dahl. The swollen costa of *Crepidopachys* is I am quite confident a female character just as it is in *Phora thoracica* Meigen and in several species in *Aphiochæta* (*costalis* v. Roser, *epeiræ* Brues, etc.), and though the sex of the type is not given by Enderlein I am, I believe, correct in accepting it as a female. In the male the costa will probably prove to be normal or at least only slightly swollen. The bristling of the legs is indicated only as "Mittelschiene wie bei *Phora* mit einer *Machrochæta* nahe der Basis der Aussenseite." No further indication is given as to their bristling and this is given only in his remarks on affinities, not in the description. I consider the genus as synonymous with *Dohrniphora* Dahl.

Pronomiophora I consider also as a synonym of *Dohrniphora*. It agrees in every respect with the description of that genus and like nearly all the females in the genus the one here described, *rostrata* Enderlein, has the long proboscis, one of the principal characteristics of the genus. I cannot conceive how this position has been created except through an inadequate knowledge of the group and the literature on it. If we carry out this system of

erecting genera for species which possess only such trifling deviations from the types of existing genera as these two, the ultimate outcome will be that we will have every species in a different genus.

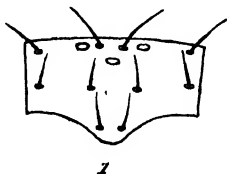
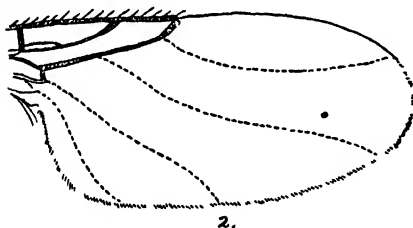


Fig. 1. *Hypocerina barberi*, gen. et sp. nov.
1, front; 2, wing.

Hypocerina gen. nov.

Head of moderate size, frons (fig. 1) broad and short with 2 rows of four bristles, one vertical and one precellar, only one pair of postantennal reclinate bristles present; anterior margin of frons produced in center, laterally excised; ocelli distinct, third antennal joint oval,

slightly pointed, arista apical, basal joints elongate; epistome produced, palpi of moderate size, proboscis fleshy. Thorax and abdomen as in *Aphiochæta*. Wings with neurulation as in *Puliciphora*, the second thick vein unforked and the median distal vein present; four distinct thin veins (fig. 2). Legs with isolated spines.

Type of genus: *Hypocerina barberi*, sp. nov.

Hypocerina barberi sp. nov.

Female: Black, subshining. Lower row of frontal bristles straight, post-antennal pair divergent. Antennæ brownish, third joint with very short whitish pilosity, arista pale, only very indistinctly pubescent on third section; palpi brown, moderately bristled. Mesonotum with short hairs and two wide placed dorso-central posterior bristles on disk, scutellum with two bristles. Abdomen opaque black, first segment very short, second dilated posteriorly, two and one-half times as long as first and with a few lateral posterior bristles, third and succeeding segments each about two-thirds as long as second. Legs brown, tibiae and tarsi paler, fore tibiae with one antero-dorsal bristle at basal third, mid tibiae with one antero-dorsal and one postero-dorsal bristle at basal third and one dorsal at apical fourth, hind tibiae with one antero-dorsal and one postero-dorsal bristle at basal third one almost dorsal bristle at below middle and a very short bristle at near apex on antero-dorsal surface, mid and hind tibial spurs long, hind pair with a shorter spur on anterior side, hind tarsus twice as long as tibia. Wings clear, costa short of middle, first division almost twice as long as second, costal fringe very short. Halteres black. Length 1.5 mm.

Type: Cat. No. 15323 U. S. National Museum.

Locality: Dead Run, Fairfax County, Virginia Oct. 26, 1912. (Barber and Schwarz). Four females, taken from a bottle which had been sunk in the ground and baited with cheese as a beetle trap.

This species bears a resemblance to the males of *Puliciphora* Dahl, but the spinose tibiae separate it at once from that genus as does also the presence of wings and halteres in the female. It also resembles the smaller species in the genus *Hypocera* from which it is separated by the presence of only two instead of three rows of frontal bristles.

Named in honor of Mr. H. S. Barber.

Aphiochæta flavipalpis sp. nov.

Male: Brown, shining; frons slightly broader than long, lower post-antennal bristles less than half the size of the upper pair, outer pair in first row of bristles nearly in line transversely with upper post-antennals, the inner pair a little lower than post-antennals, antennæ small, brown, arista longer than breadth of frons, slightly pubescent; palpi yellow, large and projecting, a very few weak bristles present; pleuræ brown, yellow on lower portions, mesopleura with a number of equal sized bristles, scutellum with four equal sized bristles; abdomen subopaque brown, segments narrowly pale bordered posteriorly, a few short, scattered hairs on all segments, those on apical segment most distinct, hypopygium large, projecting, gray dusted, ventral processes large, anal protuberance of good size, clear yellow; legs yellow, hind femora darkened at apices, hind tibial setulæ weak, most dis-

tinct on middle; wings grayish, costa to middle, first division as long as next two together, third one-fourth as long as second, fringe as long as fork of third vein, fourth vein leaving at beyond fork, slightly bent at base and ending slightly recurved at in front of wing tip; halteres yellow. Length 2mm.

Type; Cat. No. 15324 U. S. National Museum.

One male in National Museum, District of Columbia, Oct. 19th, 1912, (R. C. Shannon). Very similar to *projecta* Becker from which the unswollen fore tarsus separates it.

Aphiochaeta subciliata sp. nov.

Male and female: Black; frons glossy, about one-third longer than broad in male, slightly less in female; lower post-antennal bristles about one-half as large as upper pair in both sexes, center pair of bristles in first row much below outer pair and slightly below upper post-antennals, nearer center of frons than outer pair which are close to eye-margins; antennæ black, third joint normal in size, arista about one-third longer than length of frons, almost bare; palpi pale yellow, of normal size, moderately black-bristled, mesonotum shining, pleuræ glossy black, mesopleuræ with numerous short bristles and one long, backwardly directed one which reaches to base of halter; scutellum with two bristles; abdomen shining black, first segment shorter than second, second to fourth slightly decreasing in length, fifth and sixth elongated; surfaces of all segments with short hairs; male anal protuberance yellow, hypopygium small, but slightly exposed; legs black, fore coxæ and femora yellow, fore tibiæ and tarsi, mid coxæ, trochanters and tarsi, and extreme bases of hind tibiæ brownish; hind femora flattened, hind tibial setulæ distinct and rather widely placed (9-10); wings narrow, slightly infuscated, especially along veins, costa slightly short of middle in male, to middle in female, first division equal to next two, third division one-third as long as second, fourth vein bent at base, running slightly upward to distinctly in front of wing tip and slightly recurved at apex; fringe short and closely placed; halteres yellow, stalk darker. Length 1-2 mm.

Type; Cat. No. 15325 U. S. National Museum.

Locality: Two males, and 11 females, Washington, District of Columbia, October, 6-29, 1912, one female, Livingston Heights, Virginia, October 29, 1912 (R. C. Shannon).

This species may be mistaken in at least the male sex for *ciliata*, Zetterstedt but the costal divisions are different, and in the female of *ciliata* the fourth abdominal segment is very much shortened, being only one-third as long as the third.

NEW NORTH AMERICAN *ELATERIDÆ* AND
SCARABÆIDÆ.

BY H. F. WICKHAM,

State University of Iowa, Iowa City.

Limonius venablesi sp. nov.

Finely pubescent, slightly shining. Form moderately elongate for this genus, sides subparallel for the greater part of the length. Black, with a slightly greenish tint, the tibiæ and tarsi picescent, knees testaceous, elytra testaceous, each with two black spots, the anterior of which lies slightly in front of the middle and is nearly circular in outline, while the posterior is a little postmedian in position and elliptical, these markings being about equidistant from the side margin and the suture. Head with strong frontal concavity, the margin weak and obsolete at middle, only slightly reflexed and scarcely emarginate the punctuation strong, deep, and close. Antennæ (male) rather weakly serrate, the second and third joints subequal and together about as long or a little longer than the fourth which, in turn, does not differ much in length from those succeeding. Prothorax punctured similarly to the head but more closely at the sides, where there is a tendency to confluence, width equal to about five-sixths of the length, sides (in the male) nearly parallel except at the extreme base and apex, front angles rather prominent anteriorly and deflexed, hind angles rather long, a little divergent and blunt or rounded at the tips, indistinctly unicarinate. Scutellum finely punctured. Elytra subparallel at sides to about the apical third, thence rounding to the apices which are simple. Surface with distinct moderately impressed striæ which are marked with coarse approximate punctures, the interspaces slightly convex with close, irregular, more or less confluent but rather fine punctuation. Under side of body closely and finely punctured, the prothoracic flanks more roughly than the trunk and abdomen. Length, 8.50 mm.

The type is a male, collected at Vernon, B. C., May 14, by Mr. E. P. Venables, after whom it is named. I have had it in my collection for three or four years. A female from the same source differs in having the prothorax more narrowed anteriorly and the antennæ a trifle shorter. In the type, the antennæ pass the apices of the prothoracic hind angles by the length of two joints. With the British Columbian specimens, I associate, as cotypes, three examples taken by Mr. W. M. Mann at Pullman, Wash., though two of these latter are much larger and have relatively somewhat shorter antennæ. The largest of the Pullman specimens is about 14.60 mm. long, but the smallest scarcely exceeds the measurements of the type.

If this species be assigned a place in the table of Candèze (*Monographie des Elaterides*, III, p. 579) it would go into the second section in which the prosternal sutures are not deeply excavated anteriorly, and by the maculate elytra and carinate prothoracic hind angles would go next to *L. stigma* Hbst. However, it is not like any of the described North American species and may be recognized at sight by its size and coloration.

Aphodius iowensis sp. nov.

Oblong, moderately elongate, more parallel and less convex than usual, rufopiceous, the sides of the head and of the prothorax paler, elytra and legs reddish-castaneous, surface strongly shining and polished. Antennæ paler, the stem a little darker than the club. Head moderately convex, the three tubercles low and broad but easily distinguishable, genæ prominent but obtuse. The portion behind the row of tubercles is sparsely and extremely minutely punctured, somewhat more closely and distinctly near the sides. Clypeus with a shallow rounded anterior emargination, sides strongly divergent posteriorly, angles broadly rounded, margin narrowly reflexed, surface with fine but well separated and rather sparse granules which fade out in the neighborhood of the frontal suture. Prothorax about one and a half times as broad as long, very little narrowed anteriorly, the sides scarcely arcuate but broadly explanate, all the angles obtuse and rounded, basal marginal line showing faintly on each side of the middle; disk strongly shining, quite impunctate at middle, sides irregularly marked with deep punctures, sparse and large on the submedian area but becoming smaller and more crowded near the margin and cribrate in the impression anterior to the hind angles. Elytra at base a little narrower than the prothorax, only slightly broader behind, humeri obtuse, surface strongly shining, finely and sharply striate, striæ with regular, round, rather close, sharp punctures, interspaces flat and smooth. Body beneath with a fine alutaceous sculpture and punctate as well, the punctures distinct but rather distant over most of the ventral surface, becoming smaller and closer on the sternal side pieces. Mesosternum bluntly carinate between the coxæ. Anterior tibiæ very strongly tridentate and distinctly crenulate above the upper tooth, the spur stout and curved, first tarsal joint shorter than the second. Middle tibiæ with the spurs dissimilar, the major spur being slender and sharp, about twice as long as the minor, this latter slightly bent and chisel-shaped at tip. Hind tibiæ fimbriate at apex with unequal spinules, first tarsal joint shorter than the next three. All of the femora are sparsely punctate and hairy. Length 7.25 mm.

Collected at Lake Okoboji, Iowa, by Mr. A. O. Thomas, who has kindly given me the specimen.

This is a true *Aphodius* with short scutellum, and belongs in Horn's group I-a. From those described, it may be known by the tuberculate front, feebly emarginate clypeus, impunctate elytral intervals and punctate hind femora, this combination of characters

not occurring in any other North American species in that division of the genus. It is of special interest on account of its relation to this small assemblage of rare forms with explanate pronotal sides.

Aphodius columbiensis sp. nov.

Form rather stout, strongly convex, broader posteriorly, blackish-piceous, opaque, legs reddish-piceous, antennae testaceous, club sooty. Head without tubercles, finely and sharply but not closely punctured, clypeus emarginate at middle, angles distinct but rounded, sides diverging regularly with scarcely any arcuation to the rounded, moderately prominent genae, margin feebly reflexed, clypeal punctuation fine and rather sparse. Prothorax with the sides parallel posteriorly, arcuate for a short distance anteriorly, all the angles rounded, surface alutaceous and having besides a double system of punctuation, the larger punctures fairly evenly disposed (but allowing some smoother areas in the discal region and an impunctate median line) and ordinarily separated by approximately their own diameters, the fine punctures irregularly scattered among the others. Basal marginal line distinct. Elytra at base a little narrower than the prothorax, becoming broader behind the middle, humeri dentiform, disk very regularly but finely striate, the striae with well-marked distant punctures giving a catenate appearance to the grooves, interspaces flat, strongly alutaceous and opaque but impunctate. Body beneath rather coarsely and sparsely punctate on the meso and metasternal side-pieces, the mesosternum not carinate, abdominal punctuation indistinct, replaced by a longitudinal rugosity of the segments. Posterior and middle femora strongly but not densely punctate. Length, 5.25 mm.

Collected at Vernon, B. C., by Mr. E. P. Venable, who gave me the type specimen.

This also is a genuine *Aphodius*, belonging to Horn's group *H*, in which it approaches *A. opacus* Lec., but is at once distinguishable by the elytral striae being distinctly punctured. The fore tibiae are strongly tridentate, crenulate above the upper tooth, the edges fimbriate with yellow hairs. Both spurs of the middle tibiae are sharply pointed at their apices and of normal form, differing only in size, those of the hind tibiae are very long, slender and sharp. The basal joint of the hind tarsus is about as long as the next three. The alutaceous sculpture appears to extend to all parts of the body, even showing on the legs.

Anomala camancha sp. nov.

Size large. Surface subopaque. Form subparallel, recalling *Cyclocephala*. Color yellowish testaceous, head, tibiae, and tarsi darker, reflexed edge of clypeus, prothoracic marginal bead, outer edging of fore tibiae, and most of the spines and ridges on the middle and hind pairs piceous or blackish in somewhat varying degree,

eyes black. Head of normal size, front rather coarsely, densely, and more or less confluent but not deeply punctured, the vertex much less closely. Clypeus punctured similarly to the front but a little less strongly, the front edge nearly straight, angles broadly and evenly rounded, sides subparallel or slightly convergent posteriorly for about the basal half of the length, margin entire, somewhat strongly reflexed, frontal suture deeply impressed and about straight. Antennal club about equal in length to all of the remaining joints. Pronotum with an antemedian, shallow, dark-colored fovea each side, marginal bead strong all the way around, basal lobe barely visibly emarginate or sinuate at middle, the pronotal disk punctured, rather sparsely over most of the surface but more closely at sides, the punctuation fine, the intervening spaces alutaceous. Scutellum punctured similarly to the pronotum. Elytra a little more shining than the prothorax, distinctly and rather strongly striate, the striae punctured weakly on the disk, a little more strongly at the sides and near the base, the intervals of the dorsum distinctly alternating in height and breadth, the broader ones lower than the others and rather sharply punctured. The interval just external to the sutural stria is the widest and has the punctures arranged in a rather confused double series, while on the other two flat discal intervals the series is single. The intervals external to these are not punctured, except with the fine alutaceous marking that gives the appearance of subopacity to the elytra. Propygidium punctured, with a distinct tendency to transverse rugosity, pygidial sculpture finer and more rugose. Body beneath strongly hairy on the thoracic sternites but less so on the abdomen and femora, metasternum distinctly and closely but not very deeply punctured, abdominal segments strongly shining and sparsely punctate. Legs of moderate thickness, the posterior tibiae not dilated, the front pair bidentate, none of the claws cleft at tip, but those of the anterior tarsus are somewhat dissimilar, the inner one being a little twisted, suddenly bent near the base and with a marked thickening just external to this bend. The two claws of the middle tarsus are about alike, except that the inner is a trifle more slender, those of the hind tarsus are similar to the middle ones. Length, 13.50 to 16.50 mm.

Described from six specimens kindly given me by Mrs. Lucy Brant Meade, who collected them Aug. 9, on Capitan Mt., New Mexico.

By the non-protuberant mesosternum and nearly simple (not cleft) claws, this should go into the sub-genus *Rhombonyx* and belongs near *A. cavifrons* Lec. and *A. carinifrons* Bates, differing from both in the impressed (instead of carinate) frontal suture. It is also larger than either of the two species noted and differs from both in several minor characters which may be gathered from the description.

Anomala apacheana sp. nov.

Similar in form, size, color and luster to *A. camancha*, but is somewhat more shining and differs in the following particulars. Clypeus narrower and longer in

proportion, much more broadly rounded so that the arcuation of the angles involves the front border to the extent of loss of the straightness of the anterior margin. The clypeal disk is much less strongly punctured and the concavity is more pronounced. Frontal suture strongly carinate, front and vertex less punctured than in *A. camancha*. Prothorax with the sides a little divergent, the posterior angles slightly everted, while in *A. camancha* the sides converge a little posteriorly and the angles are not everted. Pronotal discal punctuation finer, and more scattered. Elytral striae punctuation a little more pronounced than in *A. camancha*, but that of the intervals much less so, the broadest interspace, next to the sutural stria, having a rather irregular single series only. Pygidium finely and very sparsely punctate. Claw structure almost identical with the preceding species. Length 12.25 mm.

Described from a single specimen, collected by myself, July 9, at El Paso, Texas.

This, too, is a *Rhombonyx*, differing at once from *A. camancha* in the cariniform frontal suture, agreeing in this character with *A. carinifrons* Bates and *A. cavifrons* Lec. From the former, it may be told by the thoracic punctuation ("sat dense et fortius" in *A. carinifrons*), the single punctate series on the subsutural interval and the distinct though not very strong dilatation of the major anterior tarsal claw. From *cavifrons*, it separates by the larger size, the punctate elytral intervals and the shape of the prothorax.

A GIANT COCCID FROM GUATEMALA.

BY WILLIAM MORTON WHEELER,

Bussey Institution, Harvard University.

The Coccidæ are usually described in our entomological textbooks as "small" or "minute" insects, and this is certainly true of the species of temperate regions. In the tropics, however, where the family is most abundantly represented, there are several large forms which make their congeners look like pygmies. For example, the adult female of *Hemilecanium theobromæ* Newstead, one of the species found on cacao in Cameroon, West Africa, is 13–15 mm. long and 12–13 mm. wide.¹

¹ Newstead, On a Collection of Coccidæ and Other Insects Affecting Some Cultivated and Wild Plants in Java and in Tropical Western Africa. Journ. Econ. Biol. III, No. 2, 1908, pp. 33–42, 2 pls.

Newstead has also recently described and figured an even larger species, *Aspidioproctus maximus*, the old adult female of which measures 33 mm. in length, 25 mm. in width and 15 mm. in height.¹

This occurs in German East Africa, Rhodesia and Cape Colony, chiefly on the M'sasa tree (*Bradjustagia randii* Butears). Another species of the same genus from German East Africa (*A. armatus* Newstead) is considerably smaller, measuring 12-17 mm. in length, but is nevertheless a very large Coccid.

On December, 1911, at San Lucas Toliman, on the shore of Lake Atitlan, Guatemala (alt. 5000 ft.), I found a large Coccid on the branches of one of the *Erythrina* trees (presumably *corallodendron*, the "arbol madre" of the Mexicans) very commonly used to support the barbed wires around the plantations and gardens. The tree, which bore no leaves owing to the lateness of the season, looked from a little distance as if it were covered with galls as large as cherries, but the columns of fire ants (*Solenopsis geminata*), attending these objects, soon opened my eyes to the fact that they were Coccids and not vegetable excrescences.

Some of the specimens were sent to Prof. Cockerell who pronounced them to be, in all probability, Signoret's *Lecanium sallei*, since assigned to the genus *Neolecanium* Parrott by Prof. Cockerell.² I find on looking up Signoret's description³ that it agrees very well with my specimens, though it is very brief and apparently drawn from a single specimen. This was received from Sallé, who collected it somewhere in Mexico, but without indicating the host-plant.

My specimens are all adult or nearly adult females and measure 11-20 mm. in length, 10-15 mm. in width and 9-14 mm. in height. As they have contracted since they were collected, the dimensions of the living insect are probably 2-4 mm. greater. The largest individuals have the elliptical body evenly smooth and convex above, but the smaller ones, though very convex in the mid-dorsal region, have the sides depressed and more or less distinctly transversely ridged. The ventral surface is flat or concave and under

¹ On a Collection of Coccidæ and Aleurodidæ, chiefly African, in the Collection of the Berlin Zoological Museum. Mitth. Zool. Mus. Berlin V, 2. Heft, 1911, pp. 155-174, 12 text figs.

² A Contribution to the Knowledge of the Coccidæ. Ann. Mag. Nat. Hist. (7) IX, 1902, pp. 450-454.

³ Essai sur les Cochenilles ou Gallinsectes (Homoptères-Coccidæ) IIe Partie. Ann. Soc. Ent. France (5) III, 1873, pp. 395-443.

a lens minutely wrinkled. The color of the dorsum is dull Naples or pale brownish yellow in the palest individuals. Under a lens magnifying 20 diameters the surface is slightly roughened and covered with minute brown dots, which in some specimens fuse to form irregular brown or black blotches. In many specimens these blotches have in turn fused till the whole mid-dorsal region

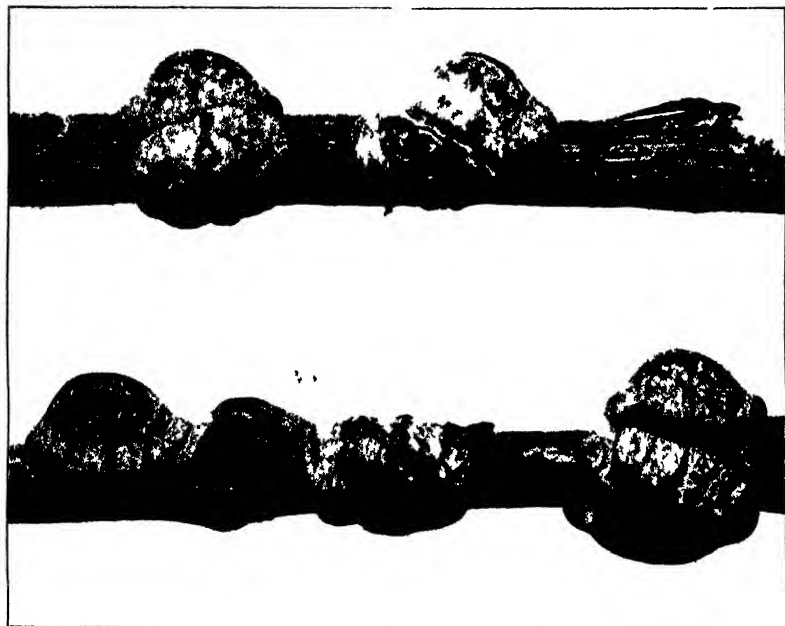


Fig 1 *Neolecanium sallei* Signoret, natural size

is dark-colored. The accompanying photographs give a good idea of the form of this Coccid and of the way it clings to the *Erythrina* twigs.

Neolecanium sallei does not seem to be a common species. Though I had occasion to examine a great number of *Erythrina* trees in various localities in Costa Rica and Guatemala, the single tree at San Lucas Toliman was the only one on which it was found.

SPECIES OF THE GENUS *GAURAX* OF THE EASTERN UNITED STATES.

BY CHARLES W. JOHNSON,
Boston Society of Natural History.

These interesting little flies are only occasionally taken in sweeping but can often be obtained in some numbers in breeding other insects, as they differ from other members of the family Oscinidæ, in feeding upon insect remains instead of vegetable matter. They are not parasitic but inquilinous or more properly speaking scavengers, the larvæ feeding upon the cast-off skins of caterpillars, pupæ cases and spider eggs.

Gaurax anchora Loew has been bred from the cocoons, etc., of *Samia cecropia*, *Hemerocampa leucostigma* (Tussock moth); *Porthetria dispar* (Gypsy moth), and egg cluster of *Corydalis cornutus*. *Gaurax araneæ* Coq., of California was reared from the egg-sac of a spider (*Argiope riparia*), and *Gaurax lancifer* Coq. of the West Indies, also from egg-sacs of spiders. The habits of the other species are unknown. The *Gaurax ephippium* Zett., referred doubtfully to this genus by Coquillett in the list of Diptera of Beulah, New Mexico, (Trans. Amer. Ent. Soc., XXIX, 106, 1903) is a *Chlorops* according to European authors.

In studying the New England species collected during the past few years, I find one new species, making four from this region. They may be tabulated as follows:—

- | | | |
|---|---|-----------------------------|
| 1 | Thorax yellow, with a black dorsal mark..... | 2 |
| | Thorax entirely black; scutellum yellow..... | <i>montanus</i> Coq. |
| 2 | Wings entirely hyaline..... | 3 |
| | Wings with the basal half smoky black..... | <i>obscuripennis</i> sp. n. |
| 3 | Thorax with a narrow anchor-shaped mark; scutellum also marked with black | <i>anchora</i> Loew |
| | Thorax with a broad mark, the posterior edge tridentate; scutellum entirely yellow..... | <i>festiva</i> Loew |

Gaurax montanus Coquillett.

Aside from the type locality, White Mountains, N. H., I have collected this species at Norwich, Vt., July 8, 1908.

Gaurax obscuripennis sp. nov.

Face black, front brown, vertex yellow, ocellar triangle and occiput black; basal joints of the antennæ yellowish, third joint black, aristæ whitish, densely pilose. Thorax yellow, with whitish hairs and a dorsal line, broad in front and becoming gradually narrower posteriorly, humerus, a small spot in front of the wing, and a large spot on the center of the pleura, black, the metanotum yellow, with a black spool-shaped mark. Abdomen black. Halteres black, stems light yellow. Legs light yellow, the apical third of the posterior femora black. Wings smoky, the basal half forward of the fifth longitudinal vein blackish. Length, 1.5 mm.

One specimen, Chester, Mass., August 7, 1912. Type in the collection of the Boston Society of Natural History.

Gaurax anchora Loew.

Elachiptera dispar Williston, in Furbush and Fernald, Rept. on Gypsy Moth, 1896, p. 390, pl. 53, fig. 12.

Collected by the writer at Weston, Mass., July 23, 1911.

Gaurax festivus Loew.

Beverly, Mass., July 20, [Burgess] (U. S. Nat. Mus.); Auburn-dale, Mass., June 12; Pottstown, Pa., August 8, (C. W. Johnson).

In addition to the above the following species was discovered among some unidentified material.

Gaurax pseudostigma sp. nov.

♀ Face, front and antennæ yellow, ocelli and occiput black. Thorax and scutellum yellow, with whitish hairs, metathorax shining, yellow, with a narrow band of black below the scutellum. Abdomen yellow, with broad bands of black on the posterior portion of the segments, the first narrowly interrupted. Halteres and legs light yellow. Wings hyaline, with a black stigma-like spot at the end of the marginal cells. Length, 1.5 mm.

One specimen, Toronto, Ontario, Canada, July 4, 1911 (M. C. Van Duzee).

POSITIVE THIGMOTROPISM OF *CULEX PIPIENS* IN HIBERNATION.

By HARRY B. WEISS,

New Brunswick, N. J.

Commencing about the middle of September, gravid females of *Culex pipiens* become strongly negatively phototropic and seek dark hibernation quarters which in the cities consist of cellars, basements, closed empty houses and the like. They must however be dark. The activity of these hibernating individuals depends entirely upon the temperature of the cellar or other place selected. If the place be warm, they are quite active when disturbed and if cold they are more or less torpid. Positive thigmotropism is of course exhibited only by those hibernating in warm places.

After having become acclimated to these surroundings, the negative phototropism seems to be entirely supplanted by positive thigmotropism. Phototropic stimuli no longer produce responses. Upon being disturbed, they fly readily, but not far from their place of rest which is usually the lower side of a wall and always return to a similar position.

A shaft of sunlight manipulated by mirrors and thrown upon specimens in these positions produced absolutely no reactions. A sixteen candle-power electric light placed a foot away from specimens and allowed to remain there for an hour, also produced no response. The insects made no attempt to fly into a region of less illumination or from a less to a greater, but remained clinging to the wall. Of course it must be remembered that they were in a slightly dormant condition. Nevertheless they responded actively to mechanical stimuli.

In addition to being positively thigmotropic, gravid hibernating females of *Culex pipiens* are negatively geotropic. They always assume a position with the long axis of the body perpendicular to the earth and the head pointing upward. Never have I seen one in a different attitude.

The tropisms of *C. pipiens* are varied and interesting. Taking the female, we find her during the summer to be normally nega-

tively phototropic. Those produced during the end of the season become strongly negatively phototropic and after entering into a state of partial hibernation, no longer react phototropically but instead become positively thigmotropic and negatively geotropic. Upon the approach of spring they become positively phototropic up to a low intensity and normally negatively phototropic and in addition positively chemotropic to certain stimuli. Herein is included the instinctive action of hibernation dependent upon or induced by several tropic stimuli.

PECULIAR HABITS OF SMALL DIPTERA, *DESMOMETOPA LATIPES* MEIG.

While collecting bees on the flowers of the wild aster on September 15, 1912, I noticed a small fly make a dash at a spider that was resting on a milkweed leaf. Closer examination showed that the spider was feeding on a plant bug, *Lygus pratensis* L., which was wholly hidden beneath the body of the spider. There were also three of the flies on the leaf an inch or so away, and occasionally one or all of them would rush in under the forelegs of the spider and cling to the body of the victim. They did not seem to mind the constantly moving forelegs and were only disturbed when the spider moved itself and prey bodily. Possibly they had to move to escape being jammed against the leaf. I was not able to make sure that they were lapping up the juices of the bug but I have no doubt that this is the reason for their actions.

The fearlessness of these small insects, barely equal to the head of the spider, was astonishing to me and I can but wonder at the acquisition of such a habit of robbery from so formidable an enemy.

All the specimens were captured and submitted to Mr. C. W. Johnson who very kindly furnished the names of them. The spider is a female *Phidippus multiformis* Emerton, and the flies are *Desmometopa latipes* Meigen.

C. A. FROST.

AN UNDESCRIBED HYMENOPTEROUS PARASITE OF THE HOUSEFLY.¹

BY C. H. RICHARDSON, JR.

During the summer of 1912, Mr. J. H. Paine reared from the pupæ of *Musca domestica* Linn. at Forest Hills, Mass., a number of specimens of an apparently undescribed Pteromalid belonging to the genus *Spalangia*. These were kindly placed at the writer's disposal and formed the basis of a life-history study which, it is hoped, will be published in the near future.

The present paper deals with a preliminary description of the species which will be known as

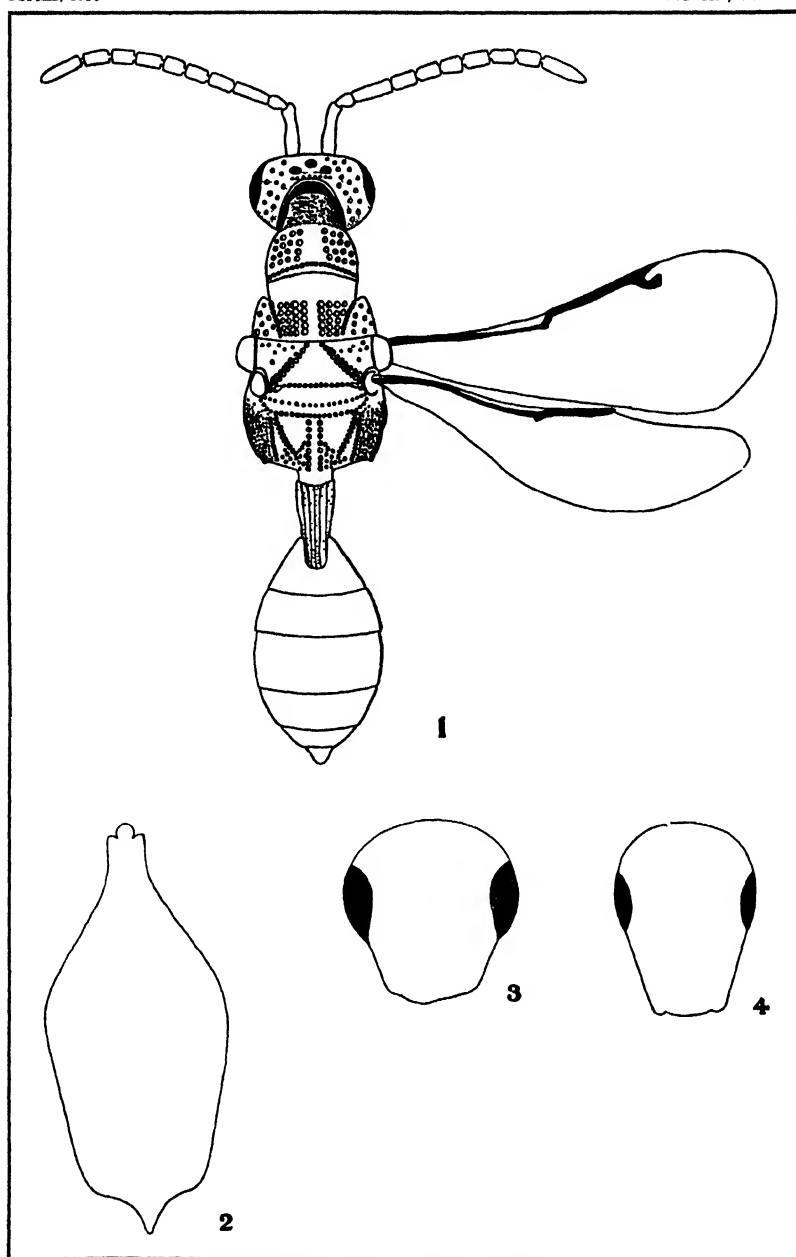
Spalangia muscidarum sp. nov.

Male: (Fig. 1) Length 3-3.5 mm. Frontal aspect of head oblong-ovate, with numerous large depressions; eyes ovate, not emarginate in front; entire head covered with a short rather stout light-colored pile; ocelli present; labrum very small in proportion to length of head, the free border rounded, hairy; mandibles bidentate, length more than twice the width at base; antennæ 10-jointed; scape as long as the three succeeding joints, covered with hair of the same texture as that on the head, second joint shortest; third joint almost as long as the succeeding two; the remaining seven joints except the last which is longer, of equal length; they are covered with fine light-colored hair; genæ punctate like the face.

Thorax above with the three divisions distinct; anterior narrowed portion of pronotum finely punctate and sharply marked off from the posterior part, which is sparsely and very coarsely punctate except for a median smooth space widest posteriorly; a transverse row of deep umbilicate punctures near its posterior margin; mesonotum smooth and polished anteriorly, sparsely punctate posteriorly and laterally leaving a smooth median space for its entire length; parapsides prominent with a few scattered punctures; parapsidal grooves deep, punctate; scutellum smooth, sometimes with several scattered punctures at sides; a distinct punctured line crosses it posteriorly; post-scutellum smooth; metanotum with two deeply punctate longitudinal lines separated by a smooth raised area; on either of these lines of punctures is a smooth space bounded posteriorly and laterally by numerous deep punctures, smallest and most abundant on the sides. Mesopleuræ each with a single fovea; an aciculate depression below and behind the tegula. Abdomen smooth except petiole which is finely aciculate; 3rd segment largest. Hind coxæ swollen; first joint of tarsi not quite as long as the succeeding four. Wings hyaline covered with short stout hairs. Venation piceous. Color of thorax deep bronze; abdomen dæneous; the tarsi yellow-brown except the last joint which is black.

The female is larger and of a more delicate structure than the male. The head is longer and narrower (Figs. 3 & 4), the antennæ are more slender and the abdomen (Fig. 2) is of different proportions.

¹Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 64.



RICHARDSON—SPALANGIA MUSCIDARUM.

Described from 1 type (male) and several paratypes of both sexes.

Spalangia muscidarum closely resembles *S. rugosicollis* Ashmead¹ from which it may be separated by the presence of a smooth median space on the posterior surface of the mesonotum and the entire absence or extreme paucity of punctures on the sides of the scutellum above the punctured line.

Eight specimens reared from *Stomoxys calcitrans* by Mr. H. Pinkus at Dallas, Texas, agree in detail with the series from Forest Hills, except that they have a more or less uniformly punctured pronotum which, in the latter, is smooth medially.

Musca has appeared as a manuscript name for a species of the genus *Spalangia*² which was taken from a puparium of the house fly by Mr. H. L. Sanford, but no description of the species has been published.

This ecto-parasite was found abundantly within the puparia of house flies, but was not known with certainty to parasitize other species. However, *Stomoxys calcitrans* Linn. whose puparium resembles closely that of *Musca domestica* was breeding quite abundantly with the latter in a region infested with *Spalangia muscidarum*, and it seems reasonable to suppose that the parasites did not discriminate between the two. The fact that the specimens from Texas obtained by Mr. Pinkus were reared from *Stomoxys* favors this view.

The writer is indebted to Dr. L. O. Howard and Mr. J. C. Crawford of the Bureau of Entomology for determination and loan of specimens, and to Mr. F. C. Bishopp for sending the Texan specimens referred to above.

EXPLANATION OF PLATE

- Fig. 1. *Spalangia muscidarum* sp. nov., male.
Fig. 2. Outline of abdomen of female.
Fig. 3. Front view of head of male.
Fig. 4. Front view of head of female.

¹Proc. Entom. Soc. Washington, Vol. 3, p. 36. (1894).

²Howard, L. O., The House Fly—Disease Carrier, Frederick A. Stokes Company, New York, 1911, p. 90.

Mr. J. C. Crawford (*in lit.*) holds that this is a described species which should be attributed to Howard, since what is probably the same form is referred to by Dr. Howard (*loc. cit.*) in the following words: ". . . a fully formed and active adult black *Spalangia* crawled immediately from the opening . . . This will be described by Girault as *Spalangia musca*." This particular specimen in question is not at present accessible; therefore we have no means of comparing it with the series under consideration.

Unfortunately the word *black*, which constitutes the entire description, will not apply strictly to this species in which the color is distinctly bronzed and a portion of each tarsus is yellow-brown as described above. Likewise if used in the cited general sense, it would apply as well to *Spalangia rugosicollis* Ashm., *S. drosophila* Ashm. or to *S. haematobia* Ashm. as to the present species; it has no diagnostic value. Moreover, since this species will soon enter economic literature, it seems highly expedient to propose a name accompanied by a description by which it may be distinguished from other members of the same genus.

NEW NEOTROPICAL ANTOCHINI (*TIPULIDÆ* *DIPTERA*).

BY CHAS. P. ALEXANDER,¹

Ithaca, N. Y.

This paper considers only the members of the Limnobiine tribe *Antochini*, a rather extensive group in the tropics. The genera have an almost Cosmopolitan distribution, occurring in both the Old and New Worlds, exceptions existing in *Styringomyia*, *Paratropeza*, *Thaumastoptera*, *Diotrepha* and *Atarba*. The material studied herein, is, for the most part, the property of Cornell University and the U. S. National Museum and to Dr. J. Chester Bradley and Mr. Frederick Knab, I am indebted for the privilege of examining these collections.

A KEY TO THE ANTOCHINE GENERA.¹

1. Cell R_1 present (Central and South Amer.) *Paratropeza* Schiner.
 Cell R_1 absent 2
2. Rostrum prolonged, at least as long as the head 3
 Rostrum shorter than the head 6
3. Rostrum about as long as the head. (Eur.; N. and C. Am.; Austral.)
 Rhamphidia Meigen.
 Rostrum about as long as the body 4
 (*Toxorrhina* group)
4. Radial sector two-branched 5
 Radial sector unforked (N. and S. Am.; Africa) *Toxorrhina* Loew.
5. Anterior branch of Rs (R_{1+2}) long, as long as the posterior branch
 (R_{1+2}) (Eur.; N. and C. Am.; East Ind.) *Elephantomyia* Osten Sacken
 Anterior branch of Rs (R_{1+2}) very short, oblique, tending to disappear.
 (Africa, America; tropics) *Ceratocheilus* Wesche
6. Cu_1 at least 4 times as long as the deflection of Cu_1 ; deflection of
 Cu_1 tending to retreat toward the wing basis. 7 (*Thaumastoptera* group)
 Cu_1 not much more than twice as long as the basal deflection of
 Cu_1 ; Cu_1 (deflection) remaining at, or near, the fork of M 9
7. M_{1+2} free at the wing-tip. (M_2 fused with Cu_1 obliterating cell M_2)
 (Europe; Seychelles Is) *Thaumastoptera* Mik
 M_{1+2} fused to the wing-tip 8
8. M_2 distinct from Cu at its tip forming a cell M_2 ; basal deflection of
 Cu_1 under the base of Rs . (Eur.; N. and C. Am.; Austral.)
 Orimarga Osten Sacken

¹ Contribution from the Entomological Laboratory, Cornell University.

- M_1 fused with Cu to the tip, obliterating cell M_1 ; basal deflection of Cu_1 retreated far toward the base of the wing. (N. and S. Amer.) *Diotrepha* Osten Sacken
9. R_1 very short, ending before the middle of the wing, the sector originating near its tip. (Australasia to Africa) *Styringomyia* Loew.
 R_1 ending beyond the middle of the length of the wing, the sector remote from the tip 10
10. Radial cross-vein present 11
 Radial cross-vein absent 12
11. R_s very long, straight, but diverging from R_1 ; basal deflection of R_{4+5} twice as long as cross-vein $r-m$; basal deflection of Cu_1 before the fork of M ; radial cross-vein usually in a direct line with $r-m$; anal angle of the wing very prominent. (Eur.; N. Amer.) *Antocha* Osten Sacken
- R_s shorter, more arcuated; basal deflection of R_{4+5} about as long as $r-m$; basal deflection of Cu_1 at, or beyond, the fork of M ; radial cross-vein usually slightly distad of the level of $r-m$; anal angle of the wing feeble. (N. and S. Am.; Asia; Australia) *Teucholabis* Osten Sacken
12. R_s short, not much more than twice as long as the deflection of R_{4+5} ; cell R_1 broader at base than at tip (*Atarba*) or else R_s gently arcuated and the veins issuing from cell 1st M_2 twice as long as that cell (*Dicranoptycha*) 13
- R_s long, and very straight, close to R_1 leaving cell R_1 extremely narrow; deflection of R_{4+5} very short, almost perpendicular to R_s at its origin; cross-vein m present in New World species. (Eur.; N. Amer.) *Elliptera* Schiner.
13. R_s originating opposite to the end of Sc ; cell 1st M_2 short, almost as broad as long. (Eastern U. S.) *Atarba* Osten Sacken
- R_s originating far before the end of Sc ; cell 1st M_2 elongate, twice as long as broad. (Eur.; N. Am.; Africa; East Ind.) *Dicranoptycha* Osten Sacken

Ellipteroides Becker², erected in 1907 for the new species, *piceus*, is almost certainly *Eriopterine*. The presence of a cell R_2 is a tribal character, not generic as considered by Becker. But one genus, *Paratropeza* Schin., occurs in the Antochine series that possesses cell R_2 , but this genus, in all other respects is a true member of that series. *Ellipteroides* is not, but seems, rather, to be a generalized form allied to *Gonomyia*. It is not at all related to *Elliptera* Schin., as Becker states, and this reference was probably made chiefly on the lack of cell 1st M_2 (discal), a very unimportant

¹*Ellipteroides*, Becker is omitted; see discussion at the end of this key.

²Becker, T. Die Ergebnisse meiner Dipterologischen Frühjahr-reise nach Algier und Tunis 1906. (Zeitschr. für Syst. Hymenopt. und Dipterol.; vol. 7, p. 239; figure) (1907).

character in this genus. The insect, *piceus*, from Algiers, N. Africa, is blackish with yellow spots; cross-vein *r* absent; cell 1st M_2 open, the outer deflection of M_3 being obliterated; R_s rather straight, but diverging strongly from R_1 , etc. *Gymnastes* Brunetti; not distinct from *Teucholabis*, the opinion of Mr. F. W. Edwards who is well acquainted with the Old World Fauna.

Teucholabis Osten Sacken

The number of species belonging to this genus now known from the American Continent is 21, of which I have seen 12.

Teucholabis venezuelensis Macq.¹ and *T. melanocephala* Fabr.² have not hitherto been recognized as belonging to this genus but there can be no question as to their position. Both species are described as having pale clouds on the wings, not distinct brown bands as in the *polita* group.

The *Limnobia bifasciata* Fabr.³ is likewise a *Teucholabis* and conspecific with *trifasciata* End;⁴ however the Fabrician name is preoccupied⁵ and so Enderlein's name is valid.

Rhamphidia scapularis Macq.⁶ is a *Teucholabis* as was indicated by Osten Sacken in 1869; still Kertész (1902) retains it under *Rhamphidia*; the same statement applies to *Limnobia simplex* Wied⁷ which is retained in *Limnobia*.

Teucholabis sackeni sp. nov.

Wings banded; thorax with a chestnut dorsal stripe; femora yellow with the tip black.

♀. Length, 4-4.5 mm; wing, 5 mm.

Fore leg, femur, 3.4 mm; tibia, 3.4 mm; tarsus, 3 mm.

Middle leg, " 3 mm; " 2.6 "

Hind leg, " 3.8 mm; " 3.1 " tarsus, 2.5 mm.

Head: rostrum, palpi and antennæ dark brown. Front, vertex and occiput rather dark brown.

Thorax: collar orange-yellow; prothorax very light yellow; mesothorax, bright yellowish-brown; præscutum with a dark brown median mark, broadest anteriorly, narrowed behind, beginning rather far behind the anterior margin of the sclerite,

¹ Macquart, Dipt. Exot.; supplément, 1, p. 19; (1846), (*Limnobia*)

² Fabricius, Entomol. Syst.; vol. 4, p. 241; (1794); (*Tipula*)

³ Fabricius, Syst. Antl.; p. 31; (1805); (*Tipula*)

⁴ Enderlein, Zool. Jahrbuch Abth. F. Syst.; vol. 32, pt. 1; p. 69, 70 (1912)

⁵ Sohrank, Enum. Ins. Austr.; p. 428 (1781) (*Tipula*)

⁶ Macquart, Dipt. Exot.; vol. 1, pt. 1; p. 73 (1838) (*Rhamphidia*)

⁷ Windemann, Ausereur. Zweifl. Insekt.; vol. 1; p. 549 (1828) (*Limnobia*)

running caudad; sides of the sclerite between the pseudosutural foves (humeral pits) and the transverse suture, almost filled with a large rounded dark brown spot, this mark not touching the dark median vitta (as in *melanocephala*); scutum, with the exterior front angles darkened; scutellum and post-notum very dark chestnut-brown. Pleuræ, propleuræ yellowish; mesopleuræ very dark brown, almost black. Halteres pale at base, stem brown, knob bright yellow. Legs: coxæ and trochanters bright yellow, abruptly contrasted with the dark pleural and sternal coloring; femora light yellow, the apical portions abruptly dark brownish-black, these dark tips rather broadest on the fore-femora; tibia dull yellow, the extreme tip brown, broadest again on the fore-tibia; tarsi dark brown. Wings: hyaline, stigma dark brown, square; wings broadly banded with pale greyish-brown, the innermost band extending from the origin of R_s to the end of 2nd Anal, almost diamond-shaped, the breadth sub-equal to the length; the middle fascia is a paler continuation of the stigma, across the cord of the wing and ending at 1st Anal, rather narrowest near the fork of M_1 ; the apical band is rather darker and fills out the wing tip, its inner margin straight and embracing the outer end of cell 1st M_1 . Venation: (See fig. a.): Cell 1st M_1 very elongate, rather square at its inner end; veins beyond cell 1st M_1 (discal) short, so that that portion of M_{1+2} between cross-veins $r-m$ and m , is longer than the distal segment of M_{1+2} . The type has the cell 1st M_1 open, confluent with cell M_2 , due to the disappearance of the outer deflection of vein M_1 .

Abdomen: tergum dark brownish-black, the apices of the segments broadly paler; 7th tergite orange-yellow; 8th blackish; valves of the ovipositor pale, orange-yellow; sternum similar, but the pale apical margin even broader, embracing the apical half of the sclerite.

Holotype, ♀, Sonsonate, Salvador, Cent. Am. (Frederick Knab, Coll.) Paratypes, ♀♀. Aguna, Guatemala, Cent. Am. (alt. 2000 ft.) (Dr. G. Eisen, coll.)

Type and one paratype in U. S. Nat. Mus. Coll. (No. 15,124).

One paratype in author's collection. I take pleasure in naming this handsome species after the "Father of American Dipterology," Baron C. R. von Osten Sacken.

This species falls in the *polita* group, the species of which may be separated by the following key:

1. Thoracic præscutum entirely shiny black. 2
 Thoracic præscutum more or less orange-yellow or brownish. 4
2. Pronotum yellowish. (Colombia) *trifasciata* End.
 Pronotum black. 3
3. Small species (♂, length, 2.5-3 mm.); legs with the basal two-thirds
 yellowish-tawny. (Brazil) *polita* O. S.
 Larger species (♀, length, 5 mm.); leg dark brown. (Costa Rica) . . *rostrata* End.

¹Enderlein, Zoölog. Jahrbuch abth. f. Syst.; vol. 32, pt. 1; p. 69, 70; fig. R_1 (1912).

²Osten Sacken, Berl. Ent. Zeitschr.; vol. 32, pt. 2; p. 189 (1887).

³Enderlein, Zoölog. Jahrbuch abth. f. Syst.; vol. 32, pt. 1; p. 68, 69; fig. Q_1 (1912).

4. Mesonotum mostly orange; a black spot on the præscutum. (Eastern Brazil)..... *pulchella*, sp. n.
 Mesonotum chestnut in the middle, black on the sides of the præscutum. (Guat.—Salvador)..... *sackeni*, sp. n.

***Teucholabis pulchella* sp. nov.**

Wings banded, thorax yellowish with a large black spot on the mesonotum; femora brown.

♂. Length, 8.3 mm.; wing, 7 mm.

Fore leg, femur, 3.4 mm.; tibia, 4.1 mm.; tarsus, 4.6 mm.; (alcoholic) ♂.

Head: rostrum and palpi brown, the apices of the segments of the latter very narrowly paler; antennæ brown. Front, vertex and occiput brown.

Thorax: pronotum light yellow; mesonotum entirely clear light yellow, except the middle of the præscutum which has a prominent rounded, transverse, brown mark extending from the level of the pseudosutural fovea back to near the suture, the caudal margin of the mark produced backward in two small lobes, one on either side of the median line. Pleuræ clear light yellow. Halteres brown, extreme base of stem pale; knob less dark than the stem. Legs: coxæ and trochanters light yellow; femora, basal half light brown, apical half dark brownish-black; tibiæ and tarsi dark brownish-black. Wings: hyaline or nearly so; an indistinct brown band across the wing from the base of Rs to the end of 2nd Anal; a much darker brown band, broadest in front begins over the cross-vein *r* and extends back to Cu; outer end of cell 1st M₂ margined with brown; tip of wing brown, the inner end of this band distant from the outer end of cell 1st M₂. Venation, as figured (Fig. h.)

Abdomen, dark brown, the genitalia swollen. Hypopygium: (See fig. l.): 9th tergite, caudal margin strongly convex; pleural pieces very stout, at the apex with two short teeth; the inner margin produced caudad and entad in an obtuse tooth; viewed from the ventral aspect, with a stout apical appendage (a) inserted on the side of the pleura, below the apical teeth described above; it is narrowed at the ends, swollen on the inner face in the middle and bears numerous hairs at its tip; just entad of the base of the apical appendage is a rounded lobe (b); between the pleuræ arises what is apparently the guard of the penis, dark brown basally, apparently less chitinated apically (c), shaped as in the figure.

Holotype, ♂, Igarape-assu, Para, Brazil; Jan. 30, 1912. (H. S. Parish, coll.)

Type in Cornell University Museum.

It is probable that the body-colors, described above as brown are, in fresh specimens, jet black and presumably shiny.

The species belongs to the *polita* group and may be separated from its allies by the key under *sackeni*.

***Teucholabis audax* sp. nov.**

Wings unbanded; body-color yellow; large, ♂, wing, 9.5-10 mm.

♂. Length, 11.3 mm.; wing, 9.7 mm.

Fore leg, femur, 8.2 mm.; tibia, 9.6 mm.; tarsus, 8.6 mm.

Middle leg, " 7.4 mm.; " 7.4 mm.; " 5.6 mm.

Hind leg, " 8.1 mm.; " 8.2 mm.; " 6.7 mm.

Head: rostrum yellowish-brown; palpi black; antennæ, first segment bright honey-yellow at the base, abruptly light brown; remainder of the antennæ dark brownish-black. Front very narrow, the eyes almost contiguous at the narrowest portion; front dark brown; the caudal portion of the vertex, and the occiput lighter, more yellowish.

Thorax: cervical sclerites elongated, brown. Prothorax very long, about as long as the mesonotal præscutum and cylindrical, broadest basally, narrowing cephalad to meet the narrow cervical sclerites; pronotum brownish-yellow. Mesothorax, præscutum medially bright orange-yellow; on the sides brown; in the middle of the sclerite, beginning near the anterior margin, broadest in front, narrowed to a point behind, is a dark brown mark; scutum pale yellow, a continuation of the præscutal pale median vitta, lobes brown, darkest laterally; scutellum bright orange; post-notum yellowish with indistinct brown stripes; pleuræ shiny orange-yellow with patches of grey bloom (possibly not normal). Halteres brown. Legs: coxæ and trochanters light yellow; femora pale yellow with the tip broadly brown, and with a brown post-medial annulus, most prominent on the hind legs; tibia dull yellow, indistinctly darker at the extreme tip; tarsi brownish-black; legs densely covered with long black hairs. Wings: hyaline, veins brown; veins C, Sc and R bright yellow; stigma rounded, dark brown, large; an indistinct brown cloud around the deflection of R_{4+5} . Venation, see figure d.

Abdomen: tergum light yellow, apical segments more brownish, hypopygium brown.

Holotype, ♂, Canal Zone, Panama, Central America. (C. H. Bath, coll.)

Type in U. S. National Museum Coll. (No. 15,126).

This vigorous species is the largest member of the genus in the American fauna. It may be readily recognized by its general yellow color (including abdomen) and its large size.

Teucholabis pleuralis sp. nov.

Wings unbanded: thorax light yellow with a dark, narrow pleural stripe; abdomen without metallic reflexions; femora yellow, brown at the tip.

♂ Length, 5 mm.; wing, 5.3 mm.

Middle leg, femora, 3 mm.; tibia, 2.7 mm.

Hind leg, " 4 mm.; " , 3.8 mm.

Head: rostrum and palpi dark brownish-black. Antennæ very dark brown. Front, vertex and occiput dark brown.

Thorax: prothorax light yellow; mesothorax: præscutum orange-yellow with a dark brown median mark, broadest anteriorly, beginning near the cephalic margin, becoming obsolete at about one-half the length of the sclerite; scutum and scutellum orange-yellow, the lobes of the scutum brownish on the antero-exterior angles; post-notum brownish-yellow with an indistinct brown median line. Pleuræ and sternum light honey-yellow, the former with a rather broad, dark brown band beginning on the cervical sclerites, running obliquely above the base of the fore coxae, through the halteres, and becoming confluent with the dark color of the

abdomen. Halteres dark brown. Legs: coxæ and trochanters light yellow; femora light yellow, the apices broadly dark brown; tibia and tarsi brownish-black. Wings, subhyaline, with a distinct dusky tinge; stigma round, brown, its posterior margin not touching R_{2+3} . Venation: Sc rather long, that portion beyond the origin of Rs slightly longer than cell 1st M_2 (discal); cross-vein r close to the tip of R_1 ; space on R_{2+3} before r , as long as the basal deflection of Cu_1 ; cell 1st M_1 very elongated, narrowed anteriorly; outer deflection of M_1 longer than cross-vein m (these two components making up the distal end of cell 1st M_2); basal deflection of Cu_1 slightly beyond the fork of M .

Abdomen: dark brown, not at all with metallic reflexions; two basal sternites yellowish.

Holotype, ♂, Aguna, Guatemala, Central America (Dr. G. Eisen, coll.)

Type in U. S. Nat. Mus. coll. (No. 15,125),

T. pleuralis is closest to *chalybeiventris* Loew¹ from the island of Cuba; it differs in its lack of metallic reflexions on the head and abdomen; prothorax yellow, not brownish; mesothorax with a conspicuous pleural stripe; femora not brownish-black except at the extreme tip; wings not pure hyaline; but distinctly suffused with darker. It is even more closely akin to the specimen which Williston² doubtfully referred to *chalybeiventris*, but no mention is made, in this description, of a pleural stripe. It is very probably the same species; Williston's specimen was from Cuernavaca, Morelos, Mexico.

Teucholabis parishi sp. nov.

Wings unbanded; color light yellow throughout; venation not like typical *Teucholabis*.

♂ Length, 5.2 mm.; wing, 4.1 mm.

Middle leg, femora, 2.6 mm.; tibia, 2.5 mm.

Hind leg, " 3.4 mm.; " 3.5 mm.

(Alcoholic) ♂.

Head: rostrum very short, pale; palpi also very short, the segments subequal, only about twice as long as broad, pale yellow. Antennæ, 16-segmented, segments 1 and 2 short, the second only a little more globular than the third, light yellowish; the apical segments apparently paler. Front broad; broader than the diameter of one eye; ommatidia of the eye large, coarse.

Thorax: light yellow, mesonotal præscutum with darker, orange, stripes (possibly brown in dry fresh specimens); the middle stripe is double, begins at the cephalic margin of the sclerite, ends just before the suture; the lateral stripes begin just behind the pseudo-sutural fovea, run caudad, crossing the suture, on the scutum represented by two spots on each lobe, the posterior one triangular; post-

¹ Loew; Wiener Entomol. Monatschr.; vol. 15, no. 2; p. 33, 34. (Feb. 1861) (*Esampyidae*)

² Williston; Biologia Centrali-Americana; Diptera, vol. 1, supplement; p. 226 (Dec. 1900).

notum rather darker yellowish. Pleuræ, light yellowish, a dark spot under the base of the halteres, above the hind coxa; a clearer-defined, though smaller, spot on the propleuræ in the vicinity of the anterior spiracle; sternum light orange-yellow. Halteres, stem short, knob large; pale yellow. Legs, pale yellow; only the two terminal tarsal segments slightly darker. Fore legs very widely separated from the middle legs as in the *Antochini*. Wings: light yellowish; veins brown, those in the costal region rather brighter-colored, stigma very indistinct. Venation: (See fig. c.): Sc short ending before the fork of Rs; what seems to be a branch of R_{4+5} arises from R_{2+3} ; I regard it as cross-vein r , although it is not complete and is very oblique in position (such as in *Paratropeza*). If this is regarded as a vein, R_2 , then the radial cross-vein is absent and the genus would run down into the *Eriopterini*; I know of no genus, at present, that can receive it.

Abdomen: light yellow; on the sides of the 6th segment rather dark brown, and here with a conspicuous widened enlargement (possibly not normal). Hypopygium: (See fig. k, ka), 8th tergite short, narrower than either the 7th or 9th; 9th (a) tergite convex on the caudal margin, with a deep median notch. Pleural pieces (b) rather narrow, cylindrical, with the appendages at the end or on the ventral face; the outer angle of the pleura produced into a blunt knob (c); apical appendages two, the dorsal one (d), fleshy, inserted near the apex of the sclerite; the ventral one (e) arising from the ventral side, far down near the base of the pleura; the base strongly swollen, the tip chitinated bearing on the inner face, a strong tooth, swollen at the base and projecting inward; the tip, slender, bent inward. What seems to be the guard of the penis (f) is elongated, slender, not swollen, but pseudo-segmented near the tip.

Holotype: ♂, Igarape-assu, Para, Brazil. Jan. 30, 1912. (H. S. Parish, coll.)
Type in Cornell University Museum.

The reference of this curious species to *Teucholabis* is provisional, only. It seems to me as though it might be considered one of the primitive forms of the genus. I take pleasure in naming this insect after its discoverer, Mr. H. S. Parish, the well-known collector and traveller.

Orimarga Osten Sacken

The following species is the second American form to be made known. The two species may be separated by the following key.

1. Thoracic pleuræ without silvery band; legs pale yellow; tip of femora, base and tip of tibia black; wings hyaline, extreme base dark yellow. (Southwest U.S.).....*arizonensis* Coquillett¹
- Thoracic pleuræ with a broad silvery-blue band; legs dark brown, uniform, wings suffused with darker. (Guatemala, Cent. Am.).....*argenteopleura*, sp. n.

¹Coquillett, "New Dipt. from N. Am.," Proc. U. S. Mus.; vol. 25; no. 1280; p. 83, 84 (1902)

Orimarga argenteopleura sp. nov.

Dark brownish black; pleuræ with a silvery-blue band; legs uniform dark brown.

♂, Length, 8.8 mm.; wing, 6.4 mm.; abdomen, 6.8 mm.

Fore leg, femur, 5 mm.; tibia, 5.3 mm.; tarsus, 5.1 mm.

Hind leg, " 5.4 mm.; " 5.5 mm.; " 4.2 mm.

♀ Length, 6.2 mm.; wing, 4.9 mm.

♂ Head: rostrum and palpi dark brownish-black; antennæ, basal segments dark, silvery-greyish pollinose; flagellar segments dark brownish-black. Front very pale blue, the vertex and occiput brown with a sparse bluish bloom; back of the eye, on the vertex, seven or eight very long dark hairs.

Thorax: mesonotum very dark brown without apparent dorsal stripes; a narrow bright silvery-blue stripe running along the extreme lateral edge of the thorax, beginning on the end of the prothoracic scutellum, continuing to above the wing-basis. Pleuræ dark brownish-black with a much broader silvery band extending from above the fore coxa back to above the hind coxa. Halteres, stem light brown, knob dark brown. Legs: coxæ, trochanters and extreme base of the femora light brown, the remainder of the legs dark brown. Wings: uniformly suffused with dark; veins almost black; extreme apice of the wings, in the ends of the radical cells, still darker brown. Venation: (See fig. f.): Rs angulated at its origin; cross-vein *r* at the tip of R; cross-vein *r-m* distad of the level of *r*; basal deflection of Cu₁ at about one-third the length of Rs.

Abdomen very elongated, dark brownish-black.

♀ Almost exactly like the ♂, but much smaller.

Holotype, ♂ Trece Aguas, Cacao, Alta V Paz, Guatemala, April 24.

(Barber and Schwarz, coll.) Allotype, ♀. Type-locality, April 26, (Barber and Schwarz).

Types in the U. S. National Museum coll. (Cat. No.)

Ceratocheilus Wesché

1910. *Ceratocheilus* Wesché; Journ. Linn. Soc. Zool.; vol. 30; p. 358.

1912. *Neostyringomyia* Alexander; Canad. Ent.; vol. 44; p. 85.

The genus *Ceratocheilus* was erected by the late Mr. Wesché for a species which he described as new (*winnsampsoni*), but which Mr. F. W. Edwards has since determined as being conspecific with the *Styringomyia cornigera* of Speiser. Neither Mr. Wesché's paper, nor Mr. Edwards' extremely valuable article (Annals and Magazine Nat. Hist.; series 8, vol. 8, p. 279-283; Aug. 1911) were available to me until after my paper was issued, wherein I erected the subgenus *Neostyringomyia*, using exactly the same type, *cornigera* Speis; consequently my name falls as a rank synonym of

Ceratocheilus. All of the species hitherto described are African. *C. cornigerum* Speiser has spotted wings but *C. gilesi* Edwards has hyaline wings like the New World form.

The discovery of this genus in America is very interesting and we may likewise expect *Styringomyia* to turn up in the Neotropical fauna, when further collections are made.

Ceratocheilus americanum sp. nov. .

Wings unspotted; thorax with dorsal stripes.

♀. Length, 10.5 mm. (excluding rostrum); wing, 5.3–6.2 mm.; rostrum, 5.6 mm.

Fore leg, femur, 5.5 mm.; tibia, 5.7 mm.; tarsus, 5.2 mm.

Middle leg, “ 5.4 mm.; “ 6 mm.; “ 4.8 mm.

Hind leg, “ 5.8 mm.; “ 6 mm.; “ 4.5 mm.

The measurements of the legs and body appertain to the ♀ with the largest wing (6.2 mm.), the paratype.

Head: rostrum and palpi dark brown; antennæ dark brown; front brown; vertex and occiput brown, with a greyish bloom behind; genæ grey. Eyes brilliant metallic green. The *corniculus* represented by a rounded plate above the base of the antennæ.

Thorax: collare very dark brown; prothorax concealed from above by the over-projecting mesonotum, only the lateral ends of the scutellum, which shows above the humeri as a rather square brown knob on either side. Mesothorax, præscutum very light buff-colored with dark brown longitudinal stripes; the middle one is broad, begins at the cephalic margin of the sclerite and continues back almost to the suture; on its caudal portion it is indistinctly divided by a pale median vitta; lateral stripes begin behind the pseudosutural foveæ, continue back to the scutum where they cover the lobes; extreme lateral edge of the præscutum buff-colored; scutum dark brown except the pale median depression; scutellum pale greyish-buff; post-notum thinly greyish with indistinct brown stripes on the sides. Pleuræ greyish with brown patches on the sides of the sternum; on the mesopleuræ, just before the wing basis and another just behind the fore coxa; sternum buffy-grey. Halteres, stem light-colored, knob dark brown. Legs: coxæ and trochanters yellowish-brown; femora light brown; tibiæ and tarsi darker brown. Wings: subhyaline, unspotted; veins dark brown. Venation: (See fig. e.); Sc ending just beyond the origin of Rs; Rs oblique, about as long as R_{1+2} ; R_1 beyond Rs about as long as the deflection of R_{1+2} . Basal deflection of Cu_1 before the fork of M.

Abdomen: tergum, sclerites dark brown, from the third outward with the basal-fourth light yellowish; valves of the ovipositor long and slender (See fig. j.). Sternites dull yellow, the extreme tip of segments one to four brown; a narrow, indistinct, linear, brown, median stripe.

Holotype: ♀. Culebra, Panama, Central America. Feb. 16, 1902. (W. M. Black, coll.) Paratype, ♀, Igarape-assu, Pará, Brazil. Jan. 30, 1912 (H. S. Parish, coll.)

Type in U. S. Nat. Mus. coll. (No. 15,127). Paratype, (alcoholic), Cornell University Museum.

The paratype does not differ except in such respects as might be caused by its immersion in alcohol.

Toxorrhina Loew

The Neotropical material that I have before me numbers 30 specimens referable to four species. *T. brasiliensis* Westwood is well-defined, but no specimens in the collection agree with Loew's description of *fragilis*. It is probable that it is an insular form, limited to the Antilles; it will be easy to recognize by its light-colored legs with darker femoral and tibial apices. My material is all continental and ranges from Mexico to Eastern Brazil.

Of the Nearctic species, I have taken *muliebris* O. S. by the hundreds, and have seen several specimens of *magna* O. S. from Georgia. The coloration of these two species is very constant and it is for this reason that I do not hesitate to describe three new tropical forms based largely on color-characters. Venation in the genus is rather inconstant, especially as regards the position of the basal deflection of Cu_1 (*pars ascendens* of Bergroth; *great cross-vein* of Osten Sacken).

In the vicinity of Para, Brazil, Mr. H. S. Parish took four species of *Toxorrhina*, including the large *brasiliensis* Westw. It would seem from this, that the tropics is the principal home of the members of this genus.

KEY TO THE NEOTROPICAL TOXORRHINÆ.

1. Tibiæ darker at the tip. 2
 Tibiæ uniform in color throughout. 3
2. Femora uniform throughout; tibiæ black at the tip. (Eastern Brazil)
 brasiliensis Westw.¹
 Femora darkened at tip; tibiæ (probably) not black at tip. (Porto Rico) *fragilis* Loew.²
3. Color light yellow; basal segments of antennæ lighter than the flagellum; abdominal sclerites dark at tip, except the sternites which are uniform yellow. (Eastern Brazil) *flavida*, sp. n.
 Color brown; antennæ unicolorous; abdominal sclerites uniform or dark at base and tip. 4

¹ Westwood, Ann. Soc. Entomol. France; vol. 4, p. 683 (as *Limnobia rhynchus*) (1835)

² Loew, Linnæa Entomol.; vol. 5, p. 401; pl. 2; f. 16, 17, 18, 22. (1851)

4. Small species (Length, ♂ 5 mm.; wing less than 5; rostrum less than 4 mm.); abdominal sclerites uniform throughout, the apices not darkened. (Eastern Brazil)..... *meridionalis*, sp. n.
 Larger species (Length, ♂, 6–6.5 mm.; wing more than 5; rostrum over 5 mm.); abdominal sclerites pale in the middle but dark at the bases and apices of the sclerites; apice of the sternites narrowly darkened. (Mexico—Eastern Brazil.)..... *centralis* sp. n.

***Toxorrhina flavida* sp. nov.**

Light yellow; basal segments of the antennæ paler than the flagellum; ♀ ovipositor with very slender acicular valves; basal approximation of Cu and 1st A slight.

♀. Length, 6, 6.7, 8.2 mm. Wing, 4.8, 5, 5.4 mm. Rostrum, 3.4, 3.7, 3.8 mm.

Fore leg, femur, 3.4, 3.8, 4 mm.; tibia, 4, 4.2, 4.5 mm.

Middle leg, “ 3.6, 4, — mm.; tibia, 4.5, 3.6, — mm.

Hind leg, “ 3.3, 3.6, 4.2 mm.; tibia, 3.5, 3.8, 4 mm.

Upper valve of ♀ ovipositor, 1.9, 2.0 mm.

Head: rostrum rather short, medium brown; antennæ, basal segments varying from light yellow to yellowish-brown; flagellar segments dark brownish-black. Front, vertex and occiput yellowish-grey.

Thorax: cervical sclerites rather dark brown; mesonotum, præscutum rich yellowish-brown, with an indistinct narrow paler median line which becomes obsolete before the suture and in some specimens is bordered on either side by a very narrow brown line; lateral margins of the sclerite dull yellowish, especially bright in front of the pseudosuture; scutum, lobes brownish-yellow, median line greyish; scutellum greyish-white suffused with brown, post-notum dull yellow tinged with brown caudally. Pleuræ uniformly dull orange-yellow. Halteres, stem yellow, knob slightly darker, tinged with brown. Legs: coxæ and trochanters yellow, the latter rather tinged with brown; femora dull brownish-yellow, not darkened at the tip; tibiæ uniform yellowish-brown; tarsi brown. Wings, veins light brown, in costal region more yellowish, subhyaline. Venation (See fig. h.) Sc_1 ending about opposite the origin of R_s ; deflection of M_{1+2} much shorter than that segment of M_{1+2} between cross-veins $r-m$ and m ; cell 1st M_2 elongated; basal deflection of Cu_1 rather near the fork of M . Basal approximation of Cu and 1st A slight, about one-fourth of Cu beyond the arculus.

Abdomen: tergum rich dull yellow, the caudal margin of each sclerite broadly brown; sternum uniform light yellow. Ovipositor of the ♀, upper valve, base slender, tip acicular, very elongate; lower valves likewise very slender.

Holotype, ♀ Igarape-assu, Para, Brazil, Feb. 1, 1912. (H. S. Parish, coll.) Paratype, ♀ Igarape-assu, Para, Brazil, Feb. 3, 1912. (H. S. Parish, coll.) Paratype, ♀ Igarape-assu, Para, Brazil; Feb. 7, 1912. (H. S. Parish, coll.) Paratype, ♀ Igarape-assu, Para, Brazil; Feb. 4, 1912. (H. S. Parish, coll.)

Types in Cornell University, except paratype No. 3, in author's collection.

***Toxorrhina meridionalis* sp. nov.**

Brown; antennæ uniform in color; abdomen uniformly light brown; ♀ ovipositor with the lower valves stout, blade-like; basal, approximation of Cu and 1st A more extensive.

♂. Length, 4.8 mm.; wing, 4.6–4.8 mm.; rostrum, 3.7 mm.

Fore leg, femur, 3–3.25 mm.; tibia, 3.85–4 mm.

Middle leg, “ 3.2–3.4 mm.; tibia, 3.5–3.6 mm.

Hind leg, “ 3.5–4 mm.; “ 3.8 mm.

♀. Length, 6 mm.; wing, 5.1 mm.; rostrum, 4.2 mm.

Fore leg, femur, 3.2 mm.; tibia, 4.1 mm.

Hind leg, “ 3.5 mm.; “ 3.6 mm.

Upper valve of ♀ ovipositor, 1.3 mm.

Head: rostrum brown; antennæ dark brownish-black, including the basal segments. Front, vertex and occiput greyish, with two indistinct brown lines on the sides of the vertex.

Thorax: cervical sclerites dark brown; mesonotum, præscutum, dark brown darkest medially, paler, almost yellow, before the pseudosuture and along the margins of the sclerite; in some, the median stripe is separated from the lateral by paler; near the suture, with the appearance of two narrow, dark brown lines; scutum, lobes dark brown, the depression between them greyish; scutellum and post-notum brown with a sparse grey bloom. Pleuræ dark brown with a sparse greyish bloom, the extreme dorsal portions of the pleuræ are darker, producing an indistinct dorsal pleural stripe. Halteres brown, extreme base of stem rather paler. Legs: coxæ and trochanters, brown; femora, tibiæ and tarsi dark brown, not darker at the tips.

Wings: subhyaline, veins brown: Venation (See fig. g.): Sc_1 ending opposite the origin of R_s ; deflection of M_{1+2} a little shorter than that segment of M_{1+2} between cross-veins $r-m$ and m ; basal deflection of Cu_1 situated far before the fork of M ; basal approximation of Cu and 1st A rather extensive, about two-fifths the length of Cu beyond the arculus.

Abdomen: segments dark brown without distinct darker markings on the incisures. Ovipositor of the ♀, upper valve, base not strong, the tip slender but relatively short; lower valve, very broad, almost as wide as the base of the upper valve.

Holotype, ♂ Igarape-assu, Para, Brazil; Jan. 26, 1912 (H. S. Parish). *Allotype*, ♀, Igarape-assu, Para, Brazil, Feb. 1, 1912 (H. S. Parish). *Paratype 1*; ♂ Igarape-assu, Para, Brazil; Feb. 4, 1912 (H. S. Parish). *Paratype 2*; ♂ Igarape-assu, Para, Brazil; Feb. 4, 1912 (H. S. Parish).

Types in Cornell University, except paratype No. 2, in author's collection.

Toxorhina centralis sp. nov.

Brown; antennæ uniform in color; abdomen with base and tip of each sclerite dark; ♀ ovipositor with long slender valves; basal approximation of Cu and 1st A moderate.

♂ Length, 6.6–7.2 mm.; wing, 6.2 mm.; rostrum, 5.1 mm.

Fore leg, femur, 4.8 mm.; tibia, 5.3 mm.

♀ Length, 7.2–8 mm.; wing, 5.1–6.3 mm.

Middle leg, femur, 4.1 mm.; tibia, 4.6 mm.

Hind leg, femur, 3.8–4.7 mm.; tibia, 4.2–4.5 mm.

Upper valve of ♀ ovipositor, 2.0 mm.

Head: rostrum dark brown; antennæ uniform dark brown. Front, vertex and occiput light grey, suffused with brown.

Thorax: præscutum rich light brown without apparent paler stripes; sides of the sclerite broadly pale buff; scutum similar, brown; scutellum and post-notum with a sparse greyish bloom. Pleuræ light brown. Halteres light brown, stem paler. Legs uniform light brown.

Wings subhyaline, veins light yellowish-brown. Venation: (See fig. i.): Sc ending opposite origin of Rs, basal deflection of M_{1+2} about equal to that segment of M_{1+2} between cross-veins $r-m$ and m ; basal deflection of Cu_1 usually at, or very close to, the fork of M; basal approximation of Cu and 1st A moderate, about one-third of the length of Cu beyond the arculus.

Abdomen, tergum, sclerites light brownish-yellow, the apice and basis of each sclerite broadly brown, each band as broad as the median pale band; sternum light yellow, the apical fifth of each sclerite brown. Ovipositor of the ♀, upper valve, very long and slender, lower valve also slender, but stouter than the upper valve.

Holotype: ♂ Surinam (H. Polah). Allotype, ♀ Surinam, (H. Polah). Paratype 1, sex? Cordoba, Mexico; April 1, '08 (Fred'k Knab). Paratype 2 ♀, Cordoba, Mexico; May 8, '08 (Fred'k Knab). Paratype 3, ♀, Cordoba, Mexico, May 8, '08 (Fred'k Knab). Paratype 4, ♂, Rio Dulce, Guatemala; Mar. 21, '06 (Schwarz and Barber). Paratype 5, ♀, Cacao, Trece Aguas, Alta V. Paz, Guatemala; April 14, '06 (Schwarz and Barber). Paratype 6, ♂, Steamship "Algiers," second day out from Port Limon, Costa Rica; June 20, 1903 (Dr. J. B. L. Layton). Paratype 7, ♀, Bocas del Toro, Panama; Sept. 28, '03. (P. Osterhout). Paratype 8, Paramaribo, Dutch Guiana (Miss K. Mayo). Paratype 9, ♀ Igarape-assu, Para, Brazil (H. S. Parish).

Types in the U. S. Nat. Mus. coll. (No. 15,128).

Paratypes in U. S. N. M., except No. 4 in author's collection, No. 8, in Acad. Nat. Sci. Phil. and No. 9 in Cornell University.

This species exhibits some differences in coloring and other variations from the type-description but I am quite certain that but one species is included. Most of the specimens show clearly the dark basis and apice of the abdominal tergites. Some variation exists in the position of the basal deflection of Cu_1 , in relation to the fork of M. In most specimens it is close to, or at, the fork; in some rather far proximad of the fork; in paratype No. 9 it is distad, underneath cell 1st M_2 . A few examples show an open 1st M_2 , occasionally one wing exhibiting this character while the opposite wing is quite normal.

Explanation of the Plate 2.

- Fig. a. Wing of *Teucholabis sackeni*, sp. n.
 " b. " " *Teucholabis pulchella*, sp. n.
 " c. " " *Teucholabis parishii*, sp. n.

Fig. d. Wing of *Teucholabis audax*, sp. n.

" e. " " *Ceratocheilus americanum*, sp. n.

" f. " " *Orimarga argenteopleura*, sp. n.

" g. " " *Toxorhina meridionalis*, sp. n.

" h. " " *Toxorhina flavida*, sp. n.

" i. " " *Toxorhina centralis*, sp. n.

" j. Ovipositor of *Ceratocheilus americanum*, sp. n.

" k. Hypopygium of ? *Teucholabis parishi*, sp. n.

Dorsal aspect. (a) 9th tergite; (b) pleura; (c) apice of pleura; (d) dorsal apical appendage; (e) ventral apical appendage; (f) guard of the penis.

" ka Ventral apical appendage, (enlarged).

" l. Hypopygium of *Teucholabis pulchella*, sp. n. Dorsal aspect. (a) apical appendage; (b) lobe; (c) guard of the penis.

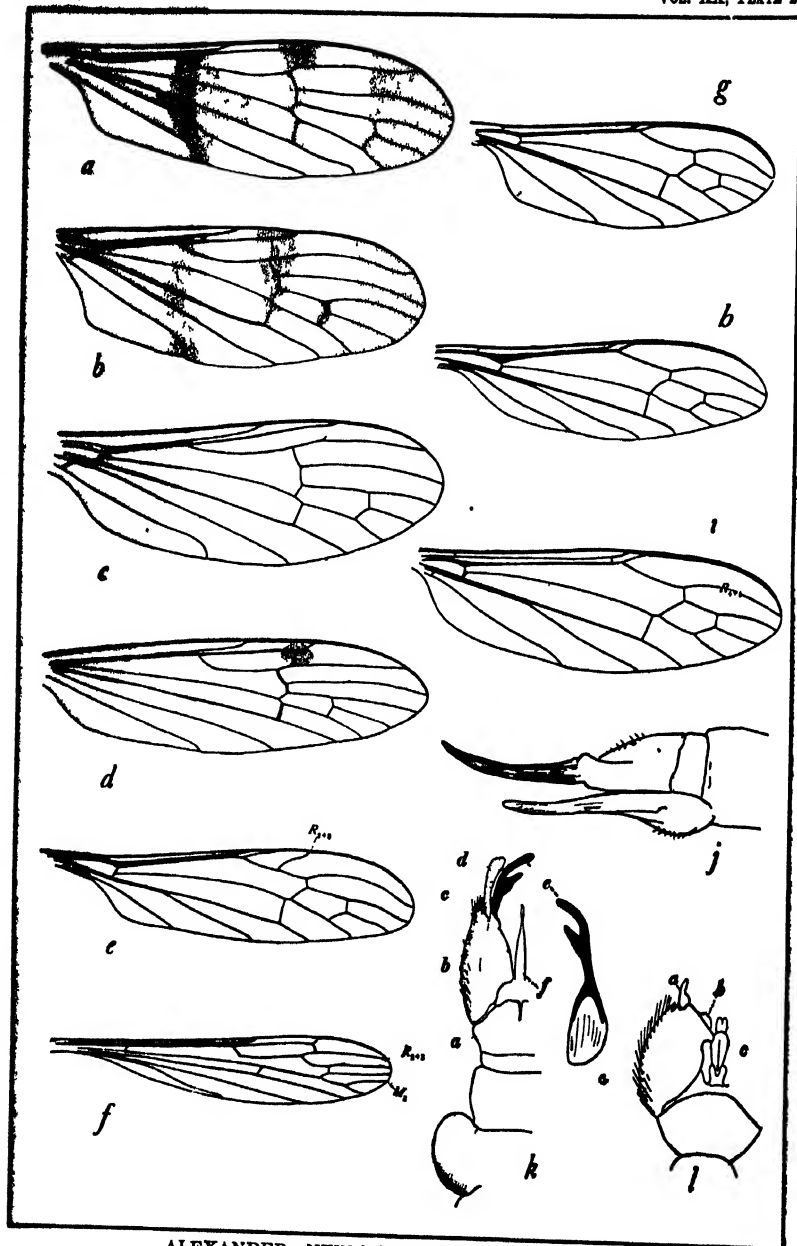
BOOK NOTICES.

Comstock, J. H. *The Spider Book.*

A Manual for the study of the spiders and their near relatives, the scorpions, pseudoscorpions, whip-scorpions, harvestmen, and other members of the class Arachnida found in America north of Mexico, with analytical keys for their classification and popular accounts of their habits. pp. XV, 721, figs. 770. Doubleday, Page & Co., Garden City, N. Y. (1912).

This large octavo volume deals with an extensive and very interesting group of Arthropods which have hitherto been given very scanty attention outside of scientific journals. In fact it is the first attempt to present in a single book anything like a complete account of the American Spiders and their allies from the combined standpoint of anatomy, taxonomy and ethology.

The general arrangement is very similar to that followed in Prof. Comstock's well-known Guide to the Study of Insects, although the volume conforms at least in binding and typography to the earlier members of the "Nature Series" issued by the same publishers. Owing to the smaller extent of most of the groups of Arachnida, their classification has in many cases been carried down to the genera or beyond, in place of the family classification of the insect manual. The mites and ticks have, unfortunately been treated very briefly, although there are complete tables for the specific determination of scorpions, pseudoscorpions, phalangiidæ, etc. The true spiders are treated with very general completeness



ALEXANDER—NEW NEOTROPICAL ANTOCHINI

regards their taxonomy except in some of the more difficult and distinctive groups and a great many species are figured by photographs as well as by line drawings illustrating their more minute structure; especially striking are the many photographic illustrations of the webs of various species. These are exceedingly good, and in spite of the great difficulty which attends the reproduction of such fine details few have been treated by the hands of the "retoucher."

From a scientific standpoint, the most valuable portion of the book is a minute account of the comparative structure of the palpi of male spiders, accompanied by numerous figures. The remainder of the external and internal anatomy is given far less space proportionately, but nevertheless rather fully treated. The ethological material is presented very generally in one chapter on "The Life of Spiders," and throughout the text are references to individual peculiarities of many of the species as these are treated in their systematic order. At the end is a brief general bibliography and an index.

Although this volume will doubtless appeal to a much smaller group of readers than the "Manual" it should serve the worthy purpose of fostering an interest in a neglected group of Arthropods, and it deserves a wide circulation.

C. T. BRUES.

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PSYCHE

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No. 2

A SYNOPSIS OF THE SAPROMYZIDAE.¹

BY A. L. MELANDER,
Pullman, Washington.

In the *Genera Insectorum*, Fascicle 68 (1908), Friedrich Hendel has given an excellent review of the group *Lauxaniinae*, generally known to American entomologists as the *Sapromyzidae*. As this work has introduced several changes in nomenclature differing from the list of species as given in Aldrich's Catalogue, and as there has appeared no complete review of the North American species, the following synopsis is offered. It may seem presumptuous to publish this review, based as it is mainly on descriptions, for I have in all but eighty species of the family in my collection for reference, but the value of working tables in assisting future students is obvious enough to excuse its appearance in print.

Naturally, the attempt to visualize a species from a brief description alone does not assure the most satisfactory results, so that the following tables give largely an artificial classification. Such attempts at reconstructing a mind-picture of the species have proved especially unsatisfactory in the big group *Lauxania*, where the assignment of the species to *Minettia* or to *Sapromyza* has sometimes been merely a guess.

I am indebted to my colleague and neighbor, Professor J. M. Aldrich, for the inspiration that prompted this review and for his material assistance in sharing his library and collection during its progress. His collection has extended the distribution of many species, and in the following pages the localities of his species are added with the designation "Aldrich." Those localities marked with the asterisk (*) are represented in my collection.

The North American species of *Sapromyza* have been twice tabulated. In 1892 Mr. C. H. Tyler Townsend published a "Preliminary Grouping of *Sapromyza*" in the *Canadian Entomologist*, pages 301 to 304. The next year appeared "El Género *Sapro-*

¹Contribution from the Zoological Laboratory of the State College of Washington.

myza en América" by Felix Lynch Arribalzaga, in the *Anales de la Sociedad Científica Argentina*, xxxiv., pages 253 to 301.

The subgenus *Sapromyza* is our dominant group. The species may sometimes be difficult to place correctly in a tabulation since their yellow color may change at death. Where confusion was most obvious the species have been several times included in the key. Spottings of the abdominal segments may become vague through a darkening of the general color. Again, there is some variation in the extent of color markings; as, for example, *univittata*, *areola*, and *vinnula*, probably varieties of a single species, show gradations in the extent of the mesonotal stripe, etc. *Flavipennis* Fabricius, with bare arista, is not the same species as *flavipennis* described by Wiedemann, although Wiedemann's specimens came from Fabricius' collection.

The following description of a new genus of Sciomyzidæ is included in this paper, since it deals with a species hitherto classed as a *Sapromyza*.

PŒCILOMYIA: A NEW GENUS OF SCIOMYZIDÆ. (Figs. 1 and 2.)

In a note in connection with the original description of *Sapromyza decora*, Loew stated that the shape of the head and particularly of the antennæ was very much like that of certain *Tetanoceras*, in view of which the species should be separated from *Sapromyza* as a distinct genus. Not recalling this note when studying specimens of *decora* I came independently to the same conclusion, and coincidentally received a letter from Mr. C. W. Johnson conveying the same suggestion.

Decora is an unusually distinct species, with its reticulate wings and maculate body. It clearly is not a Sapromyzine because of the following array of characters. These characters are invariably, or at least usually, associated with the Tetanocerine Sciomyzidæ and are not at all, or at most very rarely, found in the Sapromyzidæ.

Front broadly convex, the periorbits separated from the unusually broad, shining, central part by a strong suture; face strongly concave, the oral margin projecting, but the clypeus (Chitinhufeisen) rudimentary; cheeks nearly as deep as the eye-height; postvertical bristles divergent; second antennal joint elongate and bristly; the third joint triangular, pointed, excised above; palpi long and linear; thorax with a fine scabrous coating; prothoracic, mesopleural, and sterno-pleural bristles all wanting; front femora without a series of bristles on posterior flexor edge; middle tibiæ without preapical spur but with apical crown of bristles; wings with complete anal vein.

The species is therefore certainly to be excluded from the Sapromyzidae, and as there is no genus in the Sciomyzidae to receive it, I would propose for it the new generic name *Pæcilomyia*.

A further characterization presents the following:

Head in profile a little higher than broad, the upper portion spherical; periorbits less than one-fourth the width of the interfrontalia (Mittelleiste), separated from it by well-marked sutures which are parallel with the eye-margin on the front, but converge at the vertex to meet the sutures of the epicephalon (cerebrale) of the occiput. The interfrontalia is uniformly convex, glabrous, and highly polished, is darker than the silky periorbits, and is marked with a translucent median stripe extending forward from the anterior ocellus. The arms of the frontal suture (Stirnspaltenäste) continue weakly to the lower edge of the eye, but at the usual antennal dark spot they send a suture across to the eye thus dividing the frontal from the facial orbits (Wangendreieck). The lunula is completely covered. The face (Gesichtsleiste) narrow but widening below, at its middle no wider than the sides (Wangen), in profile considerably concave, with oral margin projecting. Clypeus (Schlundgerüst) entirely undeveloped. Palpi linear, porrect, extending beyond oral margin, hairy beneath. Checks (Backen) one-half the eye-height, hairy, rounding into the sides of the face (ohne Vibrisseneck). Paracephala (Hinterhauptsorbitsen) loosely setose; a closely setulose patch above the neck. Eyes rounded, but obliquely longer than wide. First joint of antennæ small, nearly bare, immersed in its socket; second joint conical, with the upper inner side projecting most, the outer side about one-half the length of the third joint, the inner side subequal to this joint, setose, except the outside, and with three long bristles on the upper edge; third joint pointed, somewhat excised above, uniformly fine-hairy; the dark arista rather loosely and evenly plumose above and below; the whole antenna no longer than eye-breadth, with the arista shorter than the last two joints. The bristles of the head are long and strong and include: a pair of diverging post-verticals, a convergent inner and a divergent outer vertical, 2 reclinate fronto-orbitals and a stout pair of proclinate ocellar bristles. The lesser ocellars are very small. The orbital bristles arise from dark-colored papillæ. The chaetotaxy of the thorax is as follows: 1 humeral, 0 posthumeral, 2 notopleural, 1 presutural, 3 dorso-central, 1 pair prescutellar, 2 pair convergent scutellar, 1 supraalar, and 2 approximate postalar bristles; no prothoracic or pleural bristles, except a couple (Vollarborsten) on the pteropleural ridge just under the calypter. Meso-, ptero-, and sternopleuræ with scattered fine hairs, the last with a bristle in the angle below. Calypteres pale yellow, with pale fringe. Front femora with several bristles in extensor row, hind femora ♂ biserially spinose beneath; front and hind tibiæ with preapical bristle, middle tibiæ with usual ending of bristles. Last two segments of abdomen with long submarginal bristles; hypopygium globose. Wings reticulate with alternating light and dark spots, costal margin unbroken; first vein ending midway between tip of auxiliary vein and the anterior cross vein; veins not sinuate, third and fourth veins subparallel; anal vein complete.

Type: *Sapromyza decora* Loew.

Of the eighteen genera of Sciomyzidae before me the new genus

bears most resemblance to *Trypetoptera* Hendel, but presents these differences: first vein ending far before the anterior cross vein; meso- and pteropleuræ with very fine hairs which are scarcely bristle-like; second antennal joint obconical and not rounded; calypteres pale; fronto-orbital sutures distinct, in *Trypetoptera* the periorbits are not differentiated; three dorsocentral bristles.

None of the other genera, except *Coremacera* Rondani, have the periorbits so definitely separated from the interfrontalia. The presence of three dorsocentrals and of a convex and broad middle portion of the front are unusual characters in the Sciomyzidæ.

Table of Genera.

1. Tibiæ with evident preapical bristle; two fronto-orbital bristles; postvertical bristles convergent; ovipositor not specialized, with two small lamellæ (Subfamily Lauxaniinæ) 2
 Tibiæ without preapical bristle; front with only the upper orbital bristle; postvertical bristles divergent; ovipositor flattened, with chitinous tube-like ending (Subfamily Lonchæinæ) 13
2. Face swollen, in profile convex 3
 Face flat, without convexity in the middle, in profile a straight line 7
3. Third antennal joint greatly lengthened, pointed or slender and linear 4
 Third antennal joint shortened and oval, first joint shorter than second 6
4. Two sternopleural bristles; both fronto-orbital bristles reclinate; face not strongly gibbous. (Fig. 10.) *Lauxania* Latreille.
 One sternopleural; anterior pair of fronto-orbitals convergent; face markedly gibbous 5
5. Head higher than long, occiput and front concave; the line connecting the fronto-orbitals converging in front, lower orbital bristle strongly inclined; facial groove nearly touching lower angle of eye, extending back under the eye so that the face is strongly developed underneath as well as in front; ocelli not elevated. (Fig. 6.) *Physogenia* Macquart.
 Head more globular, the front convex; fronto-orbital bristles in parallel rows; facial groove parallel with margin of eye, continuing obliquely downward leaving the cheeks free, the face in front of and not beneath this line; ocellar triangle somewhat raised. (Fig. 7.) *Pachycerina* Macquart.
6. Face with a transverse groove above the mouth, or with lateral vestiges of a groove, the oral margin projecting more or less in front of this groove; arista sometimes pubescent. (Fig. 12.) *Caliope* Haliday.
 Face swollen, with or without a transverse groove above the mouth, but the oral margin retracted beneath or behind this groove; arista plumose. (Fig. 11.) *Xangelina* Walker.
7. In profile the angle formed by the front and face acute, less than 90 degrees; front less inclined than the face, so that the mouth opening is strongly retracted 8

- Angle of front and face obtuse, the front more inclined than the face, the mouth opening therefore not retracted. 9
8. Posterior cross-vein in middle of wing; third vein sinuous. (Fig. 4.) *Procrita* Hendel.
 Posterior cross-vein beyond the middle of wing; third vein straight; eyes horizontally oval. (Fig. 8.) *Trigonometopus* Macquart.
9. Both fronto-orbital bristles reclinate 10
 Anterior pair of fronto-orbitals extending inwards and forwards; 1 sternopleural; third joint of antennæ elongate. (Fig. 9.) *Camptoprosopella* Hendel.
10. Front forming no evident angle with the face; head higher than long; fourth vein bowed forward at tip of wing, narrowing the first posterior cell. (Fig. 5.) *Griphoneura* Schiner.
 Front and face forming an evident though rounded and obtuse angle; head as long as high. 11
11. Orbital bristles arising from tubercles; wings rather slender basally. (Fig. 3.) *Chaetocelia* Giglio-Tos.
 Orbits without tubercles; wings not narrowed on basal half. 12
12. Thorax opaque or sub-opaque, ground color usually dark, ocellar bristles usually large and spaced far apart near the front ocellus, behind the ocellars typically one or two pairs of outwardly diverging small bristles; arista usually plumose and at the same time the scutellar bristles usually cruciate; front often relatively broad; wings rarely pictured; hind tibiæ often marked with a basal ring. (Fig. 14.) *Minettia* Robineau-Desvoidy.
 Thorax shining or but slightly pollinose, its ground color usually yellow; ocellar bristles usually small and placed close together behind the front ocellus, the other bristles rarely present; arista often pubescent and scutellar bristles generally parallel or diverging; convergent scutellar bristles typically not occurring with a plumose arista; front usually narrower; wings often pictured; hind tibiæ rarely annulate. (Fig. 13.) *Sapromyza* Fallen
13. Metallic black species; front rather narrow; two dorsocentral bristles. (Fig. 15.) *Lonchæa* Fallen.
 Yellow, largely yellowish, or cinereous species, not metallic: front broad; four dorsocentrals. (Figs. 16-21.) *Palloptera* Fallen.

Lauzania Latreille, sensu lato.

Including *Lauzania* s. str., *Caliope* Haliday, *Xangelina* Walker, *Minettia* Robineau-Desvoidy, and *Sapromyza* Fallen.

1. Dorsum of thorax black or blackish in ground color, overlaid or not with pollinose coating; wings never pictured (except sometimes extreme base of cross-veins infuscated). 2
 Mesonotum yellow, testaceous, reddish, or brown, not black in ground color, except rarely a median dark vitta; wings often pictured. 45
2. Third antennal joint linear, elongate, cylindrical, the first joint as long as or longer than the second; center of face protuberant; facial orbits white pruinose (*Lauzania* sensu stricto). 3

- Third antennal joint ovate or oblong-ovate, not more than four times as long as broad, the first joint shorter than the second; center of face gibbous (*Caliope* and *Xangelina*) or not (*Sapromyza* and *Minettia*)..... 10
3. Wings short and broad, brown; second vein arched forward; scutellum long and flat; four rows of acrostichals, the middle rows very indefinite; arista plumose. (N. J.; Fla., Aldrich; Ga.)*..... *Lauxania latipennis* Coquillett.
Wings not abnormally broad and short, the submarginal cell not broadened at the expense of the marginal; scutellum shorter..... 4
4. Knob of halteres black; calypteres and fringe dark; base of wings darker than remainder; arista short-plumose; front legs black, the posterior tibiae and tarsi brown..... 5
Halteres yellow or white; calypteres rarely dark; wings not blackened at base; arista white..... 7
5. Scutellum convex; body and head polished; periorbits broad, ceruleous, the median vitta of front shining black. Eur.*, N. Scot., Mass.*, N. Y.*, (N. J., Pa., Mich., Wisc. Aldrich), Ga., N. Mex., Queb.*, Ont.*, B. C.*, Alaska*. (Fig. 10.)..... *Lauxania cylindricornis* Fabricius.
Scutellum flat, white pollinose; mesonotum white pollinose except a narrow median stripe and the sides broadly; pleurae with two white pollinose spots. . 6
6. Face completely white pollinose; front opaque with the sides white pollinose, a lateral vitta cinereous and the median vitta black; arista dark except base. Fla., N. J..... *Lauxania opaca* Loew.
Face with a middle line and lateral vittae more or less white-pollinose, otherwise shining; front shining black except the narrow orbits, but viewed from above showing a black median vitta and lateral black spots circumscribed with white pollen; arista pale. (*facialis* Coquillett) Fla., Ga.*, La.*; Tenn. Aldrich..... *Lauxania trivittata* Loew.
7. Arista densely pubescent with appressed white hairs; front shining black..... 8
Arista loosely plumose; center of front opaque black; legs largely whitish..... 9
8. Mesonotum and scutellum whitish pruinose; front tibiae and tarsi black; front femora and posterior legs brownish; lunule red; 3 dorsocentrals, 4 acrostichal rows. Ariz.; Mono Lake, Cal. Aldrich.
..... *Lauxania nigrimanus* Coquillett.
- Head, thorax and abdomen shining, with slight coppery tinge; legs brownish but the posterior femora largely black; 4 dorsocentrals, 2 acrostichal rows. Cal.*..... *Lauxania albiseta* Coquillett.
9. Scutellum velvety black except at base; legs whitish, the coxae and femora black; wings yellowish. N. J., Pa., Ga.; Kans., Tenn. Aldrich.
..... *Lauxania femoralis* Loew.
- Scutellum shining, lightly white pollinose; front legs ♂ black from end of femora to tip of metatarsi, remainder of front tarsi white; costal part of wings yellowish, apex and posterior part infuscated. Pa.
..... *Lauxania manuleata* Loew.
10. Face more or less protuberant in center, in part at least polished, although sometimes with oral, orbital or subantennal pruinose markings; halteres yellow. . 11
Face flat or concave, wholly silvery, white, yellow or gray pruinose, or otherwise marked with pollen, not polished; halteres sometimes black. 24

11. Antennal arista bare or microscopically pubescent; wings nearly hyaline. 12
 Antennal arista moderately or long plumose, or with dense pubescence; front
 not yellow, except sometimes a spot on lunule; wings yellowish. 16
12. Front not vittate; insect entirely black, except halteres and wings. Cal.*
 *Caliope nigerrima* sp. nov.
 Front vittate with reddish. 13
13. Head largely yellow or red. 14
 Head black, the front anteriorly and the face in part yellowish. 15
14. Very robust, cheeks broad; head reddish except for an occipital fascia, three
 frontal vittæ, the middle one triangular, and six facial spots; scutellum and
 base of abdomen reddish; legs reddish, femora in part black; thorax polli-
 nose; third antennal joint elongate; 3 dorsocentrals, 2 sternopleurals; scutel-
 lars strongly diverging. Tex.; Miss. Aldrich. . . . *Minettia eucephala* Loew.
 Head yellow, the ocellar region and short lateral vittæ black; third antennal
 joint ovate; legs blackish, the knees and end of tibiæ tipped with yellow;
 thorax shining. D. C. *Caliope flaviceps* Loew.
15. Third antennal joint less than twice as long as wide; legs yellow except base of
 femora; 4 dorsocentrals. Tex.*, Ariz. *Caliope variceps* Coquillett.
 Third antennal joint over three times as long as wide; legs black, the knees and
 posterior tibiæ and tarsi yellow; 3 dorsocentrals. Ariz., N. M.
 *Caliope longicornis* Coquillett.
16. Scutellum flat and velvety black; legs whitish, the femora black. 17
 Scutellum convex and not velvety. 18
17. Scutellum entirely volutinous; center of front shining, laterally with a bisected
 dead-black spot. Tex.*; Kans. Aldrich. . . . *Caliope signatifrons* Coquillett.
 Scutellum subshining at base; front opaque black above the antennæ, laterally
 shining; arista very long-plumose. Mass., Pa.*, N. J. (Fig. 12.)
 *Caliope gracilipes* Loew.
18. Front tibiæ largely blackish. 19
 Front legs including coxæ yellow; arista short-plumose, white, the base yellow-
 ish; face strongly gibbous. Cal.* *Lauxania albiseta* Coquillett.
19. Thorax and scutellum white pruinose; front tibiæ and tarsi black, contrasting
 with remainder of legs; arista densely white-pilose. Ariz., Cal.
 *Lauxania nigrimanus* Coquillett.
 Thorax and scutellum shining, not or scarcely pruinose; arista dark. 20
20. Thorax with slight metallic tinge; pleuræ sometimes more or less brownish
 (compare species of alternate also) 21
 Thorax polished black, but scarcely metallic. 22
21. Thorax cæruleous, becoming reddish in back and on sides; pleuræ brownish;
 femora and tibiæ brownish, base of tarsi whitish. Mex., S. Am.
 *Caliope? flavipennis* Fabricius, Wiedemann,
 Thorax chalybeous, pleuræ sometimes brownish in part; legs black, the tibiæ
 and tarsi yellow; 2 dorsocentrals, acrostichals numerous; third antennal
 joint oblate-ovate; face moderately convex. S. Am., Mex., W. Ind., Ala.,
 La.*, N. J.; Orizaba, Aldrich. *Caliope muscaria* Loew.
22. Face in profile incised at middle, bulbous only beneath antennæ; arista pilose. 23
 Face large, bare, smooth, evenly convex from side to side and from antennæ

- to near the oral margin, just above the oral margin a narrow horizontal groove; arista plumose; deep shining black throughout, the third antennal joint and four posterior tarsi reddish. W. Ind., S. Am. (Fig. 11.)
 *Xangelina nigra* Williston.
23. Face glistening beneath the antennæ; third antennal joint four times as long as wide, dark; legs black, except knees and posterior tibiæ and tarsi. Eur., N. Scot., Wash.* *Caliope elisæ* Meigen.
 Face pollinose immediately beneath antennæ; third antennal joint three times as long as wide, often reddish; legs entirely yellowish. Cal., Vanc., Wash.*, Id.* (*livingstoni* Coquillett) *Caliope quadrisetosa* Thomson.
24. Some of the abdominal segments marked with spots; thorax opaque gray pruinose. 25
 Abdomen not regularly spotted. 31
25. Arista long-plumose. 26
 Arista short-pubescent; mesonotum with four fuscous vittæ, scutellum with two fuscous dots; front bivittate; abdominal segments with four series of brown spots; legs yellow. 30
26. Abdominal segments yellow, marked with pairs of blackish spots; thorax not vittate; scutellum cinereous black. 27
 Abdomen largely black. 28
27. Lower part of pleuræ yellow; 2 dorsocentrals and 1 sternopleural. Kans.
 *Minettia crevecœuri* Coquillett.
 Pleuræ concolorous with notum; 4 dorsocentrals and 2 sternopleurals. Md.
 *Minettia glauca* Coquillett.
28. Abdomen largely blackish, base and tip yellow, dull with thick cinereous coating; thorax uniformly cinereous, but humeri and scutellum yellow; 4 acrostichal rows; legs yellow; last sections of fourth vein subequal. Wash.*
 *Minettia univittata* var.
 Abdomen polished; thorax vittate with brown; scutellum largely or wholly black. 29
29. Abdomen black, base and tip yellow, each segment with lateral gray pruinose spots; legs whitish; thorax with four vittæ; face whitish; hind cross vein broadly brown; cross veins approximate. Nicaragua.
 *Minettia albipes* Coquillett.
 Abdomen black with hind margins of segments brownish and pollinose, fifth segment with four gray pruinose spots; legs black except tibiæ and most of tarsi; thorax with three vittæ; cheeks with black spot. Nicaragua. (*varia* Coquillett.) *Minettia variata* Hendel.
30. Abdominal segments marked with four brown spots; femora not with patches of setulæ; antennæ often black at base; cheeks with large blackish spot; Pa., N. J., N. H., Can.; Tenn., Mich., Wisc. Aldrich.
 *Minettia quadrilineata* Loew,
 Abdominal segments marked with many small brown setigerous spots; front femora with a row of minute setulæ on distal part of flexor surface; antennæ yellow. Me.*; Tenn., Wisc. Aldrich; Wash.*. *Minettia annulata* sp. nov.
31. Face silvery pollinose on a brown ground; thorax and abdomen shining bluish

- black, the pleuræ brownish; femora blackish, tibiæ brownish, tarsi whitish.
5.3 mm. S. Am., W. Ind. *Minettia argyrostoma* Wiedemann.
Otherwise; if the face is silvery the thorax is pollinose. 32
32. Arista pubescent or bare. 33
Arista plumose. 36
33. Body very slender; black, thorax gray pruinose, legs brown, the posterior
tibiæ and tarsi yellow; antennæ yellow, arista bare; wings four times the
length of the abdomen. N. H., Alaska. *Minettia brachystoma* Coquillett.
Third antennal joint partly blackish, arista pubescent. 34
34. Mesonotum trivittate; front with median brown vitta. 35
Mesonotum and scutellum uniformly dusted; front shining black except a yellow
anterior fascia, face silvery-dusted; legs blackish. Wash.*
..... *Minettia nigrans* sp. nov.
35. Face silvery white; center of scutellum brownish; abdomen black; femora
blackish, tibiæ brownish, their base yellow, tarsi more or less yellowish.
St. Vincent. *Minettia exul* Williston.
Face with small brown spot each side of center; scutellum gray-pruinose;
3 dorsocentrals of which one is presutural, 2 acrostichals, 2 sternopleurals;
venter yellow, dorsum of abdomen fuscous; base and middle ring of tibiæ
yellow. 2.5 mm. Ga.; Tenn. Aldrich. *Minettia vittigera* Coquillett.
36. Wings blackish at base; halteres black; thorax opaque black; abdomen black. 37
Root of wing not blackened; halteres yellow; thorax grayish pollinose or sub-
shining. 38
37. Front less broad, face shorter and less convex, abdomen shining. Can., Pa.,
N. J., N. H. *Minettia obscura* Loew.
3 dorsocentrals, 6 rows acrostichals; abdomen subshining, grayish pollinose.
Eur., Mass., N. J.*, Me.*, Pa.*, Que.*, Ont., Ill.*; Wisc., Mich. Aldrich.
..... *Minettia longipennis* Fabricius.
38. Mesonotum very lightly gray pollinose, shining; 3 dorsocentrals, 4 acrostichals;
head shining black. Eur., N. Am. (*frontalis* Loew).
..... *Sapromyza hyalinata* Meigen.
Mesonotum and head opaque. 39
39. Mesonotum opaque gray pollinose, with lateral margins brownish; strikingly
marked with brown setigerous spots; 2 dorsocentrals, 1 sternopleural; scutel-
lum gray pruinose; abdomen polished black, somewhat brassy. Fla., Cuba,
Aldrich. *Minettia cineracea* Coquillett.
Mesonotum not marked with brown spots. 40
40. Mesonotum vittate; abdomen largely or wholly black. 41
Mesonotum densely cinereous pruinose, not vittate. 42
41. Mesonotum blackish, almost opaque, with two narrow gray vittæ, scutellum
black, abdomen reddish terminally; head yellow; legs light yellow. W. Ind.
..... *Sapromyza puella* Williston.
Mesonotum opaque black, with four white-pollinose vittæ; scutellum black
with white-pollinose margin; abdomen thinly gray-pollinose, shining at apex;
head black. W. Ind. *Minettia albovittata* Loew.

42. Scutellum bordered with velvet black; palpi black; legs mostly yellow; 3 dorsocentrals, 4 acrostichals. Eur.*, Alaska, Que.*, B. C.*, Vanc.*. Mass.*, N. H., Vt.*, N. Y., N. J., Pa.*, Ill.*, Mont.*, Wyo.*, Id.*, Wash.* (Mich., Wisc., Or., Tenn., Kans. Aldrich) (Fig. 14)... *Minettia lupulina* Fabricius.
- Scutellum entirely gray-pollinose; palpi yellow..... 43
43. Abdomen black, cinereous pruinose, base of segments 3, 4, 5, black-fasciate; head yellow, upper part of occiput and vertex black; legs mostly black. Nev.; Pine Lake, So. Cal. Aldrich; Wash.*..... *Minettia cæsia* Coquillett.
- At most a brownish fascia on those segments; head mostly black in ground color..... 44
44. Legs yellow, front of femora, a basal ring and apex of tibiæ sometimes darker; face yellowish with central U-shaped brown spot and facial grooves black. D. C..... *Minettia magna* Coquillett.
- Legs black; face uniformly overlaid with gray pollen. Mass.*..... *Minettia cana* sp. nov.
45. Species whose wings are marked or spotted in some way or other..... 46
- Species with wings not at all ornate, except sometimes at very base, or with uniform infuscation..... 63
46. One or both cross-veins alone with brown clouding; usually 4 dorsocentrals... 47
- Costal margin before submarginal cell as well as one or both cross-veins brown; generally 3 dorsocentrals. 51
- 2, 3 and 4 veins tipped with a brown dot, cross-veins clouded and third vein with one or two additional spots..... 61
- With numerous confluent black dots and an apical spot surrounded by eleven dots; opaque gray spotted with brown on head, thorax and abdomen; legs yellowish, femora with two rings, tibiæ with one; halteres black. D. C., Tex. *Minettia stictica* Loew.
47. Arista long-plumose; thorax with four brown vittæ; face with black central spot; front with ocellar mark; base of antennæ black; abdominal segments trimaculate; hind tibiæ ringed. Nicaragua, Tex. *Sapromyza picticornis* Coquillett.
- Arista short-plumose or pubescent; thorax yellowish; face and front uniformly yellow; antennæ yellow; abdomen not spotted; tibiæ not ringed. 48
48. Thorax opaque, dusted; 3 dorsocentrals, 6 uniform acrostichals; arista nearly bare; front longer than broad; hairs of lower facial ridge large; mesopleuræ setulose. Ill.*; Kans. Aldrich..... *Minettia ordinaria* sp. nov.
- Thorax subshining; 4 dorsocentrals, 4 acrostichals, the middle rows setiform; mesopleuræ bare..... 49
49. Arista short-pubescent; front broader than long; brown of cross-veins suffused. 50
- Arista plumose; front longer than broad; clouds of cross-veins blackish; macrochætæ strong. Ill.*; Or. Aldrich..... *Minettia nubila* sp. nov.
50. Last ventral segment ♂ dilated or with two strong black teeth, lamellæ rounded and black-pilose; abdominal segments margined with long setæ; ocellar bristles closer together than width of front ocellus. Neb.; Mass.*, Vt.*, Ill.*, Ind.* (Mich., Wisc., S. Dak., Kans. Aldrich) *Sapromyza bispina* Loew.

- Abdomen not furnished with spines; entire insect yellow; ocellar bristles separated more than the width of the front ocellus; ♂ lamellæ long and linear Mex., N. J., B. C.*; Cal. Aldrich. *Sapromyza innuba* Giglio-Tos.
51. Mesonotum vittate; face maculate. 52
 Mesonotum not vittate; face not spotted. 54
52. Mesonotum opaque yellow and with four vittæ; posterior tibiæ with basal ring; fifth vein not brown. 53
 Mesonotum brown and bivittate, pleuræ bivittate; tibiæ more or less brown but not ringed; fifth vein brown; face with two oral spots; abdomen testaceous; the last two segments with median vitta. S. Am., Mex. *Sapromyza geminata* Fabricius.
53. Face with a median oral spot; pleuræ bivittate; abdomen with three rows of brown spots; arista short plumose. W. Ind. *Minettia octovittata* Williston.
 Face with black antennal spots and with a pair of dusky oral spots; pleuræ obsoletely maculate; abdomen reddish; arista short-pubescent; oral hairs more prominent than usual, the foremost almost bristle-like. Mass., D. C., N. J., Va., Fla., La.* *Sapromyza umbrosa* Loew.
54. Scutellum with two black spots on margin; arista bare; abdomen with darkened incisures and median vitta. Mex., S. Am. *Sapromyza bipunctata* Say.
 Scutellum unicolorous; arista pubescent to plumose; abdomen yellow to brown but not marked. 55
55. Brown of costal margin arising over posterior cross-vein and confluent with cloud on this cross-vein; ♂ lamellæ large, black-hairy; second joint of hind tarsi black, in ♂ broad; arista short-pubescent. Que., Ont., Me., N. H., N. J., Pacific Coast; Mass.*, Pa.*, Ill.*, Tex.* (Mich., Wis., Tenn., S. Dak. Aldrich) *Sapromyza compedita* Loew.
 Brown of costal margin arising near base of wing and usually separate from cloud on posterior cross vein; second joint of hind tarsi rarely differentiated from the others. 56
56. Brown of costal margin including the anterior cross-vein. 57
 Brown of costal margin separate from anterior cross-vein. 59
57. Brown of costal margin in addition to apical cloud extending backward as three broad blunt projections, the first including the anterior cross-vein, the other two not passing the third vein; arista plumose; abdomen brown. Brazil, Mex. *Sapromyza contigua* Fabricius.
 Brown of costal margin with two rather slender projections in front of cross-veins in addition to the apical cloud; arista short-plumose; abdomen reddish 58
58. Costa broadly brown; second joint of hind tarsi not differentiated. N. Y. *Sapromyza sheldoni* Coquillett.
 Brown of costa quite narrow at end of second vein; second joint of hind tarsi black, in ♂ somewhat widened. Mass.* *Sapromyza houghii* Coquillett.
59. Brown of costa stopping at fourth vein. S. Am., Mex. *Sapromyza latelimbata* Macquart.
 Brown of costa extending beyond fourth vein at apex of wing. 60

60. Arista with scarcely perceptible pubescence. Ariz.
 *Sapromyza hubbardi* Coquillett.
 Arista short-plumose. Mex. *Sapromyza stata* Giglio-Tos.
61. Third vein with a single spot near middle of last section; 4 dorsocentrals; arista short-plumose. Que., N. H., Mass.*, N. J., Pa.*, La., Ill.*; S. Dak. Aldrich. *Sapromyza philadelphica* Macquart.
 Third vein with two spots near middle of last section. 62
62. Hind femora ♂ with black setulæ beneath; three dorsocentrals; arista long-plumose. Eur., N. H., N. Y. *Sapromyza notata* Fallen.
 Hind femora bare; four dorsocentrals; arista short-plumose. Pa., N. J., Cal., Wash.*. *Sapromyza fraterna* Loew.
63. Abdominal segments marked with regular series of spots, or vittate. 64
 Abdomen not seriately maculate. 77
64. Face with brown or black spot in middle above oral margin; usually scutellum bimaculate also. 65
 Face yellowish, not spotted; usually the scutellum not maculate. 68
65. Basal joints of antennæ black; pleuræ bimaculate; thorax with a narrow median vitta; 2 dorsocentrals, no acrostichals, one sternopleural; middle tibiæ without preapical bristle; segments 3, 4, 5 of abdomen bimaculate, a dorsal vitta on last three segments. Fla. *Sapromyza slossonæ* Coquillett.
 Antennæ entirely yellowish; pleuræ not maculate. 66
66. Thorax quadrivittate; hind tibiæ with basal ring; pleuræ bivittate; the flat disc of the scutellum with two indefinite broad brown marks; arista short-plumose; upper side of abdominal segments trimaculate; palpi black; 3 dorsocentrals, 6 acrostichals. Tex., W. Ind., Brazil, N. J.; Mass.*, La.*; Kans. Aldrich. *Minettia macula* Loew.
 Thorax not clearly vittate; tibiæ not ringed; pleuræ not vittate; scutellum bimaculate. 67
67. Segments 2, 3, and 4 each with two spots, ♂ with median vitta on terminal segments also. W. Ind. *Sapromyza octopunctata* Wiedemann.
 Abdomen with series of median and lateral spots; arista short-pubescent. W. Ind. *Sapromyza ingrata* Williston.
68. Mesonotum vittate. 69
 Mesonotum not vittate; scutellum not maculate. 72
69. Mesonotum with broad median vitta; palpi yellow; arista plumose; tibiæ not ringed; hind femora tipped with two small dark spots; abdominal spots not clearly defined, sometimes forming a basal fascia on the segments. Cal.*
 *Minettia univittata* Coquillett.
 Mesonotum with lateral vittæ; palpi blackish; arista short-pubescent. 70
70. Hind tibiæ with proximal ring; scutellum typically bimaculate; mesonotum quadrivittate; 4 dorsocentrals, 2 acrostichals, 2 sternopleurals; antennæ red; 71
 Tibiæ not ringed; scutellum not maculate; notum shining, with three broad vittæ, the median geminate; third antennal joint black; abdominal segments more or less trimaculate. St. Vinc. *Sapromyza venusta* Williston.

71. Abdominal segments with series of four fuscous spots; femora not with patch of setulæ. Pa., N. J., N. H., Montreal; Mich., Tenn., Wisc. Aldrich.
..... *Minettia quadrilineata* Loew.
Abdominal segments with many small fuscous setigerous spots; front femora with a row of setulæ on distal part of flexor surface. Me.*, Wash.*; Wisc., Tenn. Aldrich..... *Minettia annulata* sp. nov.
72. Abdominal segments fasciate, their marginal setæ strong..... 73
Abdominal segments spotted..... 74
73. Abdomen brown with hind margins of the segments and a median vitta darker; palpi brown. Mex..... *Minettia vinnula* Giglio-Tos.
A basal or middle fascia on abdominal segments, basal segments more or less vittate; palpi red. Cal.*, Or.*, Wash.*..... *Minettia flaveola* Coquillett.
74. Last two or three segments of abdomen with round black spot on each side; 1 dorsocentral, 6 acrostichals; palpi yellow. N. H., Alaska, Idaho*; Yukon Terr. Aldrich..... *Sapromyza rotundicornis* Loew.
Abdomen with a median row of spots..... 75
75. Abdominal segments with median spots only..... 76
Last four segments of abdomen with both lateral and median spots; palpi yellow; mesonotum pruinose, scutellum shining. Nicaragua.
..... *Sapromyza triseriata* Coquillett.
76. Mesonotum little shining; arista pubescent; wings gray hyaline, penultimate section of fourth vein but little more than one-half the ultimate; front narrow; palpi black at tip. W. Ind..... *Sapromyza sororia* Williston.
Mesonotum polished; arista plumose; wings yellowish, penultimate section of fourth vein about one-third the ultimate; face strongly convex; front broad.
Fla..... *Caliope lutea* Coquillett.
77. Mesonotum entirely yellow or reddish, not vittate with darker stripes..... 78
Mesonotum vittate or blackish above..... 90
78. Scutellum with two black spots at the bristles; insect otherwise entirely luteous. S. Am., W. Ind..... *Sapromyza grata* Wiedemann
Scutellum not maculate..... 79
79. Scutellum black, with base brownish; pleuræ with brown mark before wing; abdomen black; arista long-plumose. Mex..... *Sapromyza sonax* Giglio-Tos.
Scutellum and abdomen yellow..... 80
80. Face centrally marked with a velvet-black spot; front with a black ocellar spot; arista pubescent; notum thinly gray-pruinose, 3 dorsocentrals, 4 acrostichals; length 2.5 mm. N. H..... *Sapromyza puncticeps* Coquillett.
Face not maculate..... 81
81. Last ventral segment ♂ with lateral acute projections directed backward; arista short-pubescent..... 82
Abdomen not with such projections..... 83
82. The ventral spines very large, broad and conspicuous; ♂ lamellæ rounded, black-pilose. (*conneza* Say is probably the ♀) Mass. to Kans.
..... *Sapromyza bispina* Loew.
The ventral spines slender; ♂ lamellæ minute, short black-pilose. Neb., Mex.
..... *Sapromyza tenuispina* Loew.

83. Shining luteous species with black palpi and a black ocellar spot; mesonotum with two lighter vittæ. Ga., Fla., N. J., N. Y.
 *Sapromyza resinosa* Wiedemann.
 Otherwise. 84
84. Palpi brown; abdomen brown, the segments more or less fasciate on hind border and with long bristle-like hairs; front yellow. Mex.
 *Minettia vinnula* Giglio-Tos.
 Palpi and abdomen yellow. 85
85. Arista plumose; antennæ yellow. 86
 Arista nearly bare; tip of antennæ blackened; ocellar bristles long; front broader than long; thorax at least subshining; scutellar bristles diverging. 89
86. Thorax dull with yellow pruinosity; ocellar bristles and thoracic setulæ strong; 2 and 3 segments of abdomen with long bristles near hind margin, especially on sides; 3, rarely 4, dorsocentrals, 6 acrostichals. 87
 Thorax shining; ocellar bristles rudimentary; front yellow. 88
87. Arista rather long-plumose; wings nearly hyaline; front with faint yellow fascia bordered with brown. Cal., Or., Wash.*
 *Minettia flaveola* Coquillett.
 Arista short-plumose; wings strongly infumated; front not fasciate. Cal. Aldrich. *Minettia fumipennis* sp. nov.
88. Front as broad as long; arista long-plumose on upper side. Fla., Ga., W. Ind.*; Tenn. Aldrich. *Sapromyza sordida* Wiedemann, Williston.
 Front one-third broader than long; arista very long-plumose. Ga., La.*
 *Sapromyza amida* Walker.
89. Front with central black spot; 4 dorsocentrals; third antennal joint twice as long as deep, the upper side excised. Wyo.*. *Sapromyza cyclops* sp. nov.
 Front yellow; 3 dorsocentrals; third antennal joint short-ovate. Id., Wash.* (Fig. 13). *Sapromyza monticola* sp. nov.
90. Mesonotum with narrow vittæ; front quadrate. 91
 Mesonotum with broad vittæ, or dark above. 92
91. Arista plumose; thorax brownish, with two narrow grayish stripes; antennæ black; scutellum and base of abdomen black. W. Ind.
 *Sapromyza puella* Williston.
 Arista pubescent; thorax reddish, with four slender brown stripes; antennæ red, tipped with brown. W. Ind. *Sapromyza lineata* Williston.
92. Third antennal joint black; arista short-pubescent; palpi mostly black; thorax shining yellow with three broad brownish stripes, the middle one obsoletely geminate. W. Ind. *Sapromyza venusta* Williston.
 Antennæ yellow, the arista long-plumose; palpi yellow; thorax opaque, univittate or the disc dark. 93
93. Mesonotum with a median broad dark stripe, at least the humeri yellow; hind femora tipped with minute shining black dot on each side; 3 or 4 dorsocentrals, 4 acrostichals; front yellow. Cal.*
 *Minettia univittata* Coquillett.
 Disc of mesonotum dark; front brown on upper half. 94

94. Face with a U-shaped brown mark flanked by an oblique stripe; pleuræ not vittate; femora striped with gray in front, tibiæ with a basal ring. D.C.
 *Minettia magna* Coquillett.
 Face yellow; pleuræ vittate above; legs yellow. Kans.
 *Minettia crevecœuri* Coquillett.

Caliope nigerrima sp. nov.

♂. Length 3 mm. Entirely black, the halteres, calypteres and wings alone yellowish. Front shining, with slight coppery hue, slightly broader than long, the ocellar bristles approximate: face in profile convex only near the antennæ, broadly angulate at the middle; center and sides of the face white-pruinose; lower occiput white-pruinose. Third antennal joint elongate-oval, twice as long as wide, the black arista microscopically pubescent. Palpi linear, black-hairy. Mesonotum shining greenish black, thinly coated with olivaceous pollen; four dorsocentrals, acrostichals very sparse, apical scutellars divergent, two sternopleurals. Abdomen shining, slightly metallic. Wings hyaline, with yellowish tinge, veins yellow, last two sections of the fourth vein nearly one to two.

A single specimen taken by Professor Aldrich at Pacific Grove, California, May 6, 1906.

The profile of the face indicates that this species is related to *quadrisetosa* and *elisæ*, but the uniformly black color and the sub-bare arista are different.

Caliope elisæ Meigen.

Meigen's original description calls for a species with white arista and red antennæ. Zetterstedt states that the arista is white and the tip of the antenna is brown. Schiner says that the infuscation of the antenna is variable and that the arista is light brown; while Rondani and Becker give the arista as brown.

This species was included in the North American fauna on Walker's authority. I have a series of specimens from Mount Constitution, on Orcas Island, Washington, that agree with the descriptions of *elisæ*, and may or may not be the same as the European species. In the absence of typical specimens of *elisæ* it would be premature either to describe them as new or to vouch their identity. They have the face but little bulbous beneath the antennæ and below the swelling it is excised in profile. This character is quite different from the evenly convex face of *cylindricornis*, with which species *elisæ* is repeatedly compared. The third antennal joint is dusky, four times as long as deep, its upper and lower edges parallel, so that before the tip it is not smaller

than in the middle. The face is pollinose only along the orbits and not at all in the middle beneath the antennæ. The front legs are the darkest, their knees only are broadly yellowish.

Minettia nigrans sp. nov.

♀. Length 4 mm. Shining black, with pale wings. Occiput shining black; front one-fourth broader than long, shining black with bluish tinge, especially on the broad paraorbits, the front edge above the antennæ yellow, ocellar bristles moderate, rather distant; face not convex, uniformly white-pruinose; cheeks white-pruinose except the narrow shining oral margin; proboscis and palpi black. Thorax highly shining black, but the disc of the mesonotum dusted with gray, scutellum concolorous; three postsutural dorsocentrals, four rows of acrostichals, two sternopleurals; mesopleuræ with weak setulæ; scutellar bristles long, convergent. Abdomen shining black, the marginal setæ about two-thirds the length of the segments. Front legs entirely black, middle femora black except the knees, their tibiæ and tarsi blackish, hind femora black, the tibiæ and tarsi blackish, hind tibiæ without preapical bristle. Halteres white. Wings large, clear hyaline, veins pale, the last two sections of fourth vein proportioned two to five.

One specimen from Monroe, Washington; May 20, 1908.

Minettia cana sp. nov.

Like *lupulina* but the scutellum not bordered with black, palpi yellow, face uniformly gray-pruinose, and front lacking the conspicuous yellow fascia: like *glauca* but the abdominal segments not spotted and the front differently marked.

♀. Length 4 mm. Head and thorax black, thickly covered with blue-gray pollen. Middle of front with a broad brown fascia and orbits with a triangular brown spot at the level of the antennæ. Above the base of the antennæ the front shows but little trace of yellow ground-color, but is blue-gray pruinose like the face, vertex and occiput. Ocellar bristles distant, behind them are six cruciate setulæ. Antennæ reddish brown, the third joint ovate, with short-plumose brown arista. Palpi reddish yellow; proboscis black. Three dorsocentrals, four rows of acrostichals, the acrostichals and the other setulæ strong, metapleuræ setulose, two sternopleurals; mesonotum not vittate, scutellum uniformly cinereous above. Abdomen entirely yellowish, the segments not margined with long setæ. Legs blackish, the front legs black, front femora cinereous, knees narrowly yellowish, posterior tibiæ with base and a broad medial ring somewhat paler, hind tibiæ without preapical bristle. Halteres yellow. Wings uniformly with yellow tinge, as in *lupulina*; the last two sections of the fourth vein equal.

One specimen received with a lot of *lupulina* from Dr. Garry deN. Hough, who took it at New Bedford, Massachusetts, on Memorial Day, about twelve years ago.

Minettia annulata sp. nov.

♂ and ♀. Length 3 mm. Very close to *quadrilineata* Lw., in size, structure, chaetotaxy, color, and variations in color, but distinguishable by its different sexual structures, the setulae of the front femora, and the maculation of the abdomen.

Ground color mostly blackish, although sometimes quite testaceous, overlaid on head and thorax with dense cinereous pollen. Front large, a little broader than long, with two well-defined darker vittae extending from the antennae to the level of the posterior ocelli, elsewhere cinereous; ocellar bristles of moderate length and well separated from each other; face cinereous-white, the ground color beneath the antennae sometimes more or less blackish, along the orbits whitish; below the eyes the cheeks are marked with a large darker spot. Antennae yellowish, the third joint ovate; arista short-pubescent. Palpi black. Mesonotum blackish to testaceous, with alternating stripes, five cinereous and four fuscous, with four strong dorsocentral bristles, of which one is presutural, with but two definite rows of minute acrostichals, one intraalar; mesopleurae with scattered short hairs; two sternopleural bristles; scutellum rather flat, cinereous except for the continuation on its disc of the median fuscous vittae of the notum. Abdomen subshining, brownish to yellow, with numerous small brownish mottlings, most distinct at the bases of the submarginal rows of bristles, the mottlings toward the base of the segments sometimes confluent to form vague resemblances to the maculations of *quadrilineata*; hind margins of segments paler; marginal bristles nearly as long as the segments; hypopygium narrowly and deeply cleft, the two sides of the emargination sharply projecting ventrally as a pair of finger-like processes, ventrally at the base of the hypopygium there is another pair of black acuminate recurved processes. Femora brown to yellow but the underside of each with a well-defined dark spot near the distal third, the spot of the front pair provided in both sexes with a row of about ten microscopic close-set black teeth along the inner edge: tibiae with basal dark ring opposite the femoral mark; tarsi dull yellowish. Halteres whitish. Wings uniformly subhyaline, the last two sections of the fourth vein proportioned three to five.

Nine specimens are before me from East Eddington, Maine (Hough), Price County, Wisconsin (C. F. Baker), Knoxville, Tennessee (Aldrich collection), and Mount Constitution, Washington, July 3, 1908.

Loew's species *quadrilineata*, well represented in Professor Aldrich's collection from Pennsylvania, Michigan, Tennessee, and Wisconsin, differs as follows: The stouter hypopygium is broadly emarginate, the finger-like prolongations of the sides of the excision dark in color and the basal pair of black acuminate processes straight and approximate. Unless the hypopygium is open these structures are not to be seen. The femora usually lack the distal black spot and always are devoid of the row of

denticles. Moreover, the maculation of the abdominal segments is not in the form of small setigerous spots.

Minettia nubila sp. nov.

♀. Length 4 mm. Body with antennæ, mouth-parts, legs and halteres entirely flavous, wings hyaline with yellowish tinge, the cross-veins broadly blackish. Third antennal joint oval, one-half longer than deep, the black arista moderately long-plumose, the hairs of the lower side nearly as long as the upper. Front slightly longer than broad, not shining; ocellar bristles long, located on a line with the posterior ocelli but in back of the front ocellus; hairs of lower facial ridge minute; postverticals strong. Thorax lightly dusted, subshining, not vittate, thoracic bristles relatively strong, four dorsocentrals, the foremost much in front of suture, four rows of acrostichals, the middle rows setiform, two sternopleurals, scutellar bristles convergent. All the abdominal segments but the first with submarginal rows of bristle-like hairs. Brown cloud of anterior cross-vein extending along the third and fourth veins to form an II-shaped spot, brown of posterior cross-vein similarly extending on the fourth vein, but not on the fifth, so that its outline is narrowly triangular.

One specimen, collected near Chicago, Illinois, August 10, 1901. Another typical specimen in Professor Aldrich's collection is labeled Lawrence, Kansas.

VAR. A female specimen from Hood River, Oregon, in Professor Aldrich's collection differs in having the bristles reduced in size. The genitalia are small, with the lamellæ of the ovipositor blackish and densely dark-pilose. The front is relatively a little broader and the clouds of the cross-veins are less distinct.

Minettia ordinaria sp. nov.

♂. Length 4 mm. Dull testaceous including the appendages; wings hyaline, the cross-veins with faint clouds. Third antennal joint broadly oval, the black arista with very short pubescence. Front slightly longer than broad, opaque with reddish pollen, except that the orbital bristles arise from spots of yellowish-gray pollen. Ocellar bristles moderate in length, spaced apart a little more than the width of the front ocellus, the lesser ocellar bristles distinct; occipital setulæ and those of lower facial ridge conspicuous, the foremost like an oral vibrissa. Thorax opaque, not vittate; setulæ of thorax well developed, forming six acrostichal rows; mesopleuræ with numerous setulæ in addition to the usual macrochèta; three dorsocentrals, all postsutural. Marginal setæ of third and fourth abdominal segments as long as the segments: hypopygium, small, the lamellæ retracted. Tibial spurs of moderate length. Penultimate section of fourth vein two-thirds the length of the ultimate section.

One specimen, collected in 1897 at Chicago, Illinois, and another in Professor Aldrich's collection taken at Lawrence, Kansas.

Minettia fumipennis sp. nov.

♂. Length 5 mm. A stout and large species easily recognized by its strongly infumated wings. Very close to *flaveola* Coquillett, differing only in the dark wings, more protuberant center of the face and shorter plumosity of the arista. In *flaveola* the hairs of the upper side of the arista are as long as the depth of the third antennal joint and also conspicuously longer than the hairs below. In *fumipennis* the hairs of both sides of the arista are of the same length and are less than one-half the depth of the third antennal joint, i. e. short-plumose. The infuscation of the wings is strongest in front: along the hind border the wings are subhyaline. Chaetotaxy and structure as in *flaveola*. Color testaceous.

One specimen in Professor Aldrich's collection, taken near Stanford University, California, 21 October, 1905.

Sapromyza cyclops sp. nov.

♀. Length 4 mm. Testaceous yellow throughout, except a shining black spot in center of front, and outer one-half of third antennal joint black. Front one-third broader than long, shining; ocellar bristles strong and closely approximate behind the front ocellus; cheeks two-thirds the eye-height; face flat, the central part sericeous. Third antennal joint nearly twice as long as the width in front of the arista, its upper edge concave so that the upper apical corner is rounded-rectangular; arista microscopically pubescent. Thorax lightly yellow-tomentose, four postsutural dorsocentrals, the rows diverging posteriorly so as to meet a moderately-sized intraalar bristle; six rows of scattered acrostichals; two sternopleurals. The abdomen of the dried specimen is somewhat brownish, lightly pollinose, the last segment shining. Femora with the usual bristles of moderate size. Wings hyaline, with yellowish tinge, veins yellow, the posterior cross-vein darker; anterior cross-vein a little beyond the middle of the discal cell, opposite the end of the first vein; penultimate section of the fourth vein four-fifths as long as the ultimate, last section of fifth vein one-half the length of the posterior cross vein.

The distinguishing characteristics of this species are the yellow color, black-spotted front, black-tipped antennæ with excised antennal joint and nearly bare arista, and clear wings.

One specimen collected by Dr. W. M. Wheeler at Dinwiddie Creek, Wyoming, September 5, 1895.

Sapromyza monticola sp. nov. (fig. 13)

♂ ♀. Length 3.5 mm. Entirely testaceous, except the tip of the antennæ.

Front about one-fourth broader than long, fine-hairy in front, shining, a line connecting the front-orbital bristles would meet the base of the antennæ; ocellar bristles spaced apart the width of the front ocellus just behind which they are located, the lesser ocellar bristles minute; face receding, but the clypeus prominent,

in color pale yellow, neither shining nor sericeous, the central part of the face is twice as broad as the sides: cheeks scarcely one-half the eye-height, the lower edge with minute hairs: palpi and proboscis yellow, rarely the tip of the palpi blackened: Third antennal joint oval, one-half longer than broad, the outer third to half blackened, the arista microscopically pubescent.

Mesonotum shining, very thinly yellow-pollinose, three postsutural dorso-centrals, four definite rows of acrostichals; one intraalar, apical scutellars convergent, usually but one pronounced sternopleural, mesopleuræ not setulose. Abdomen shining, no long marginal bristles, hypopygium small, compressed. Front tarsi sometimes a little dusky. Wings with decided yellowish tinge, the last section of the fourth vein nearly two times the penultimate section, the last section of the fifth vein nearly as long as the posterior cross vein.

Seventeen males and twelve females. One specimen from Bellingham, Washington, two from Tacoma, all the others from Moscow Mt., Idaho; June to August. One female is a variant in having the anterior cross vein located further towards the end of the wing, so that the penultimate section of the fourth vein is about one-third the ultimate.

Genus *Camptoprosopella* Hendel.

1. Mesonotum and pleuræ each with a median dark vitta; wings strongly infumated. Mex., N. Mex., Col.* (*melanoptera* Hendel) *dolorosa* Williston.
Thorax not or but faintly vittate; wings nearly hyaline.....2
2. Arista densely plumose, third antennal joint somewhat tapering, three times as long as broad. N. J., Fla., Ga.*, N. Mex., Peru; S. Dak. Aldrich. (*xanthoptera* Hendel) (fig. 9). *verticalis* Loew.
Arista more loosely plumose, the third antennal joint oblong-ovate, less than three times as long as broad. Me., Ont.*, Mass., N. Y., N. J.*, Pa.*, Ind.*, Ill.*, Wisc., La.*, Ala.*, Tex.*, N. Mex., Col.*, Wyo.*, Cal.*, Mex., Nicaragua,* W. Ind.*, S. Am.; (N. H., Mich., S. Dak., Ia., Kans., Vera Cruz, Oaxaca, Puebla, Cuba, Aldrich) (*cincta* Loew; *plumata* Wulp; *ocellaris* Townsend; *claripennis* Coquillett)..... *vulgaris* Fitch.

Mr. Aldrich has informed me that Mr. Coquillett corrected the name *claripennis* to *claripennis* in the separata he distributed, and Mr. C. W. Johnson, who has recently examined his type specimen of this species in the National Museum, writes that it is *verticalis*, under which name he submitted the specimen. The error in describing the species as new under the name *claripennis* was occasioned by Mr. Coquillett's misidentification of the dark colored *dolorosa* as *verticalis*. So writes Mr. Johnson.

Genus *Chaetocelia* Giglio-Tos.

1. Wings brown except most of second posterior cell and the anal angle which are hyaline, brown of center of wing without clear spots; face not or but feebly maculate; thorax brown punctate. Mex. *palans* Giglio-Tos.
Brown of center of wings with clear spots; face with two evident black spots. 2
2. The larger part of the second posterior cell and of the anal angle brown, disc of wings with three clear spots, two on fourth vein and one on posterior cross-vein. Mex., S. Am. (fig. 3) *distinctissima* Schiner.
The larger part of the second posterior cell and of the anal angle hyaline. 3
3. The brown area of the wings between the second and fifth veins with many irregular clear spots; abdominal segments not margined with setigerous black spots. Mex. *caloptera* Hendel
Wings with two small round clear spots near tip of third vein and another above posterior cross-vein, near which spots the brown is more intensive, discal cell largely hyaline. W. Ind. *angustipennis* Williston.

Genus *Griphoneura* Schiner.

Blackish, shining, thorax not vittate; antennæ yellowish, arista plumose; face white-pruinose; legs black, the tibiae and tarsi brownish; wings yellowish with the apical third brown, more intensive in front. 5 mm. Mex., S. Am. (fig. 5.)
 *imbuta* Wiedemann.

Genus *Procrita* Hendel.

Shining yellow, abdomen black; costal half of wing brown, sharply extending in several places into the hyaline portion. Mex. (fig. 4) *pectinata* Hendel.
 Entirely shining yellow, the small ocellar triangle and the tip of the antennæ alone black; brown of wings including the costal portion, ends of the veins, and the hind cross-vein. Costa Rica. *sigma* Hendel.

Genus *Trigonometopus* Macquart.

1. Wings hyaline, cross-veins bordered with brown, third vein with two brown spots; yellow, mesonotum quadrivittate and scutellum brown. Col.
 *punctipennis* Coquillett.
 No round wing-spots. 2
2. Costal margin narrowly brown, cross veins slightly clouded; reddish, mesonotum darker laterally. W. Ind. (fig. 8) *rotundicornis* Williston.
 Wings with vitta including third and fourth veins and a cloud at end of second vein; yellow, thorax quadrivittate with brown, scutellum brown except a median line. Ga. *vittatus* Loew.

Genus *Physogenia* Macquart.

1. With sub-alar round velvet-black spot. 2
 Without such mark on pleuræ; testaceous, thorax obscurely brown-vittate.
 Cal. *planiscuta* Thomson.

2. Face translucent yellow; thorax weakly bivittate. S. Am., Mex.* (*urina* Giglio-Tos)..... *ferruginea* Schiner.
 Face trimaculate; thorax quadrivittate. W. Ind.*, S. Am.; Vera Cruz, Aldrich
 (*obscuripennis* Bigot, *variegata* Loew, *nasalis* Thomson) (fig. 6)
 *vittata* Macquart.

This genus is easily recognized by the greatly swollen and translucent face. The species are reddish yellow in color. The brief description of *Lauxania planiscuta* by Thomson brings to mind the other species of *Physogenia*: the testaceous color, the convex protuberant glabrous face, the position of the anterior cross vein much beyond the end of the first vein and the vittate thorax are rather distinctive characters. Possibly it is a synonym of *ferruginea*. *Lauxania nasalis* Thomson is certainly the same as *vittata* Fabricius. The erect dark stripe of the pleura, surmounted by a velvety black spot, the black dots above the antennæ, and the greatly swollen face indicate the synonymy.

Genus *Pachycerina* Macquart.

The North American species previously assigned to *Pachycerina* are to be found in *Camptoprosopella*. The present species differs from the type of *Pachycerina*, the European *seticornis* Fallen, in the following structural characters which hardly have generic value: The occiput is flattened instead of convex, the face is gently convex instead of bulbous, the anterior fronto-orbital bristles are more strongly inclinate, the third antennal joint is elongate-linear and the short arista is loosely plumose, instead of the antennæ tapering and arista with appressed pubescence. There are three dorsocentral bristles, six distinct rows of acrostichals, one humeral, one presutural, two notopleural, one supraalar, two postalar, one pair prescutellar, four scutellar, the apical pair parallel, one mesopleural, one sternopleural and one prothoracic, all but the last two directed backwards, the sternopleural and prothoracic bristles directed upwards. *Seticornis* has four dorsocentrals and two rows of acrostichals, but the other bristles are arranged as in the following species.

From *Camptoprosopella* the present species differs in the convex face and narrower facial orbits. In *Camptoprosopella* the sides of the face are broad and join the oral margin so that the central portion of the face takes no part in the formation of the cheeks.

Pachycerina ornata sp. nov. (fig. 7)

♀. Length 4 mm. Largely testaceous, the lower part of the head paler yellow, ocellar prominence and a large round spot in center of face shining black. Base of antennæ reddish, becoming black beyond the arista; arista reaching but two-thirds the length of the third joint, loosely plumose, long- above and short-plumose below. Oral margin retracted; proboscis yellow, palpi black. Thorax with the following markings: humeri, scutellum and posterior half of mesopleuræ whitish yellow; two transverse bands blackish, one in front of scutellum including the pteropleuræ, and another including the front half of the mesopleuræ continuing across the notopleural suture to the mesonotal suture and then broadly interrupted across the disc of the mesonotum. Abdominal segments, except the first, with broad sub-basal black fasciæ, interrupted along the median line. Legs yellow, front tarsi dusky, all the tibiæ with preapical bristle. Calypteres and fringe yellow, but a dusky spot on the margin. Halteres yellow. Wings hyaline, with a very faint yellowish tinge: anterior cross-vein beyond the end of the first vein, the last two sections of the fourth vein subequal; last section of fifth vein shorter than posterior cross vein and one-sixth the length of the preceding section.

Two specimens from Professor Aldrich's collection, received from Mr. Crawford, who collected them at Dona Marcia, Chiapas, Mexico.

Genus *Lonchæa* Fallen.

1. Arista plumose; third antennal joint short, testaceous; legs piceous, tarsi testaceous. Mex. *discrepans* Walker.
Arista bare or short-pubescent. 2
2. Front with a median reddish vitta; venter yellowish, with a broad black stripe; legs brown. W. Ind., Ga. *glaberrima* Wiedemann.
Front and venter not red or yellow. 3
3. Antennæ not reaching the oral margin. 4
Antennæ reaching or surpassing the oral margin. 9
4. Legs entirely black or blackish. 5
Metatarsi yellow. 6
5. Metallic black, scutellum more green, abdomen deep metallic green. 1.5 mm.
W. Ind. *orchidearum* Townsend.
Shining black, scarcely at all metallic, abdomen thinly covered with brownish dust; calypteres with brown cilia. 3 mm. Eur., Alaska, Wash.*
. *deutschii* Zetterstedt.
6. Cheeks bristly; front femora strongly setose beneath; two basal joints of tarsi yellow; calypteres yellow; head, thorax and abdomen deep metallic green; front of ♀ two times as long as wide, its sides parallel. St. Vinc.; Cuba, Aldrich. *brevicornis* Williston.
Cheeks hairy, at most with one or two bristles in front; legs not with stout bristles. 7

7. Calypteres fringed with dusky hairs; lunule bare; base of tarsi alone yellow; arista bare. 8
Calypteres yellow, with yellow fringe; lunule hairy; tarsi largely or wholly yellow; arista microscopically pubescent; third antennal joint large, longer than broad; front of ♀ slightly narrowed anteriorly; epistome projecting. Eur., La.*; Id., Aldrich. *laticornis* Meigen.
8. Third antennal joint orbicular, not longer than broad; front broadly quadrate, not at all narrowed anteriorly, the lunula broadly arched; face retreating, the epistome retracted, the face very wide, its sides white-pruinose; tarsi noticeably flattened. Eur.; Id. Aldrich. *parvicornis* Zetterstedt.
Third antennal joint longer than broad; front of ♀ narrowed anteriorly, the lunula highly arched; epistome projecting; side of face less pruinose and face not unusually wide. Eur.; Id. Aldrich, Mont.*. . . . *viridana* Meigen.
9. Legs entirely black or blackish. 10
At least base of tarsi yellowish. 13
10. Head, thorax and abdomen metallic blue-green; antennæ greatly surpassing the oral margin. S. Am., Mex. *chalybea* Wiedemann.
Head and thorax jet black, or at least but little metallic; antennæ reaching the oral margin. 11
11. Vertex opaque, with three shining spots. 12
Vertex black; abdomen metallic black; legs and antennæ fuscous. Brazil, Cuba, N. H. (*nigra* Wied., 1830, nec. Meig. 1826). . . . *wiedemanni* Townsend.
12. Anterior cross-vein beyond the apex of the auxiliary vein; calypteres pale yellow. Eur.*; Wash., Wisc. Aldrich. *vaginalis* Fallen.
Anterior cross-vein before the apex of the auxiliary vein; calypteres fuscous. Eur., Alaska. *hyalipennis* Zetterstedt.
13. Calypteres with white cilia. 14
Calypteres with blackish cilia. 15
14. Head, thorax and abdomen deep shining black; wings tinged with light brownish yellow; metatarsi yellow. W. Ind. *longicornis* Williston.
Thorax and abdomen more or less metallic blue-violet or bluish green; face entirely white-pruinose, nearly flat in profile; wings hyaline; tarsi yellow except the tip brown. Mass., N. H., N. Y., N. J., Pa., Ga., La.*, Ind., Ill.*, S. Dak.*, Ariz., Wash.*, Mex. [*polita* Say (1830); *cerulea* Walker (1849) *rufitarsis* Macquart (1851)] (fig. 15). *polita* Say (1830)
15. Thorax pilose; front shining black. Eur., Ga., Id.*. *tarsata* Fallen.
Hairs of thorax relatively short; front matte-black. Eur., Alaska. *albitarsis* Zetterstedt.

Genus *Palloptera* Fallen.

1. Cross-veins not bordered with brown; thorax gray-pollinose; auxiliary and first vein and apex of wing brownish. Alaska, Wash.* (fig. 21) *terminalis* Loew.
Cross-veins bordered with brown; thorax and abdomen yellowish. 2
2. First vein wholly included in the brown color, costa wholly or almost entirely brown. 3

First and auxiliary veins brown only at costa, the base and middle of costa not brown, wing also tipped with brown. Eur.*, N. H. (fig. 17)

-*arcuata* Fallen.
3. Front half of wing and posterior cross vein broadly brown.....4
Wings mostly hyaline, the submarginal cell clear except at tip. Alaska, Wash.*
Id.*, Col.; Cal., Nev. Aldrich. (fig. 19).....*jucunda* Loew.
4. Head, thorax and abdomen largely cinereous-pruinose; brown pattern of wings sharply defined; abdominal segments setose; four rows of acrostichals. Mich. (figs. 16, 20).....*setosa* sp. nov.
- Head, thorax and abdomen shining yellow; brown of wings diffusing into hyaline portion.....5
5. Abdomen setulose, but with strong marginal bristles arising from black spots; acrostichals dense. N. J.*, Pa., Que., N. H.; Va., Ia. Aldrich.
.....*superba* Loew.
- Abdomen with hind edges of the segments narrowly and the sides broadly margined with black. Me.....*similis* Johnson.

Palloptera setosa sp. nov.

♂ ♀. Length 3.5 mm. Pale cinereous in color covered especially on occiput and mesonotum with whitish gray pruinosity; anterior portion of front, face, cheeks, scutellum, pleurae, abdomen, halteres, calypteres and legs becoming yellowish; base of antennae and mouth-parts testaceous; outer portion of third antennal joint infuscated. Arista dusky, pubescent. Four dorsocentrals, one of them presutural, four rows of sparse delicate acrostichals. Abdominal setae arising from minute black dots, rather robust, the marginal ones a little stronger; fifth abdominal segment elongate. Anterior half of wing, apex and broad cloud about posterior cross vein infumated, a small clear costal spot just before the end of the auxiliary vein, the brown surrounding the cross-veins more saturate, remainder of wings clear hyaline; posterior cross-vein at right angles to the fifth vein; last section of fourth vein arched.

Two males and one female collected by Professor Aldrich at Battle Creek, Michigan. The female has a slender hyaline stripe extending down the middle of much of the submarginal cell.

EXPLANATION OF PLATE 3.

1. *Poecilomyia* (new genus of Sciomyzidae) *decora* Loew.
2. *Poecilomyia decorata* Loew. Front and face.
3. *Chaetocoelia distinctissima* Schiner. From Hendel.
4. *Procrita pectinata* Hendel. Wing, from Hendel.
5. *Griphoneura imbuta* Wiedemann. From Hendel.
6. *Physogenia vittata* Macquart. Profile of head.
7. *Pachycerina ornata*, new species. Profile of head.
8. *Trigonometopus rotundicornis* Williston. Profile, from Williston.
9. *Camptoprosopella verticalis* Loew. Profile of head.

10. *Lauzania cylindricornis* Fabricius. Profile of head.
11. *Xangelina nigra* Williston. Profile of head, from Williston.
12. *Caliope gracilipes* Loew. Profile of head.
13. *Sapromyza monticola*, new species. Profile of head.
14. *Minetia lupulina* Fabricius. Front and face.
15. *Lonchæa polita* Say. Profile of head
16. *Palloptera setosa*, new species. Profile of head.
17. *Palloptera arcuata* Meigen Wing.
18. *Palloptera superba* Loew. Wing.
19. *Palloptera jucunda* Loew. Wing.
20. *Palloptera setosa*, new species. Wing.
21. *Palloptera terminalis* Loew. Wing

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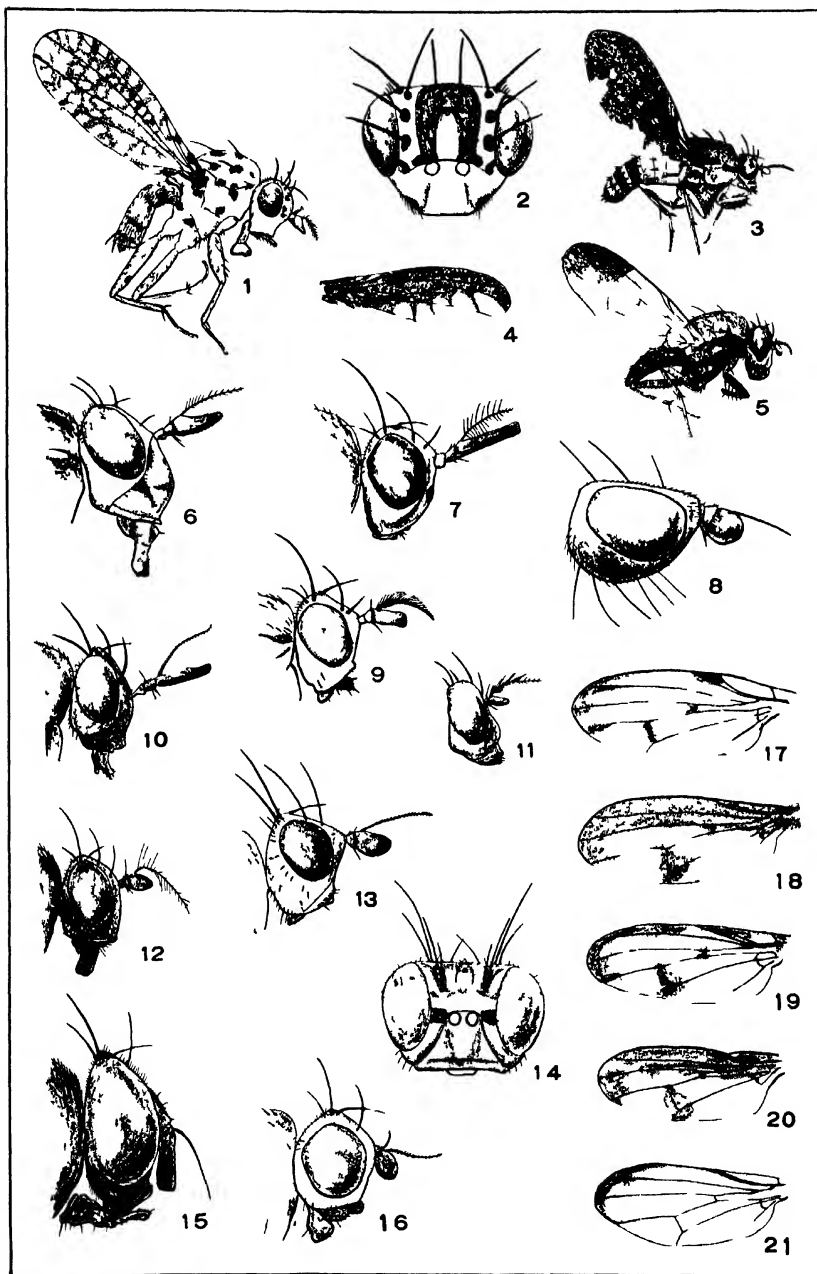
Injurious Insects. How to recognize and control them. By Walter C O'Kane.
Pp. 1-414, figs., 606 The Macmillan Company, New York

This little book is without a parallel in so far as a concise and scientific treatment of economic entomology is concerned. It is built on a plan of three parts. Into the first part O'Kane gathers material which deals with the structure, habits and classification of insects. Some of the subjects in this part are very lightly touched, but enough of insect adaptations and habits are given to arouse an interest in people engaged primarily in the control of noxious forms. The second part deals with various methods of control such as crop rotation and mechanical means involving banding, screening and trapping. Many insecticides for biting and sucking insects are given as well as repellants and fumigants. This is followed by three illustrated chapters on spray machinery and its uses. Part three is entitled "Injurious Insects" and constitutes the bulk of the book. This section deals with insect pests of garden and field crops and with those infesting orchards and small fruits, followed by a chapter on household pests and one on those of domestic animals. Each economic species is treated separately, and with the aid of the excellent photographs which accompany each description, one is able to recognize the insect in question. The life history and habits which are naturally bound up with the injury inflicted to plant or animal are discussed in a clear and concise manner. If a method of control is known, it invariably follows.

O'Kane's conciseness in exposition and consistency in treatment are two of the book's most prominent features. The sentence construction in places is not as good as it might be, but this occasional weakness is not such as to cause any great difficulty. The photographs are another feature worthy of mention for they are well chosen and usually illustrate the insect, its stages and its destructive work, all of which should aid materially in identification.

The book is of such a nature that few would care to read it through from cover to cover, but it will undoubtedly prove to be an invaluable handy reference work to both entomologist and layman.

R. W. GLASER.
Bussey Institution.



THE STANFORD EXPEDITION TO BRAZIL, 1911.

J. C. BRANNER, *Director.*

NEUROPTEROID INSECTS FROM BRAZIL.

BY NATHAN BANKS
East Falls Church, Va.

Mr. Mann turned over to me a small but very interesting collection for study; some of them were in alcohol, and these cannot always be placed with certainty, so that a few caddice flies remain unnamed.

Several of the species show a relationship with the fauna of western Argentina; but there are hardly enough species for generalizations in this regard.

PSOCIDÆ.

Thrysophorus speciosus Busmeister.

Several examples of this striking species from Porto Velho, Brazil (Mann coll.) known from many parts of South America.

Ischnopteryx cincta Enderlein.

One specimen from Porto Velho, Amazonas, Brazil. Previously known from the Amazon Region.

Psocus albostigmus sp. nov.

Dark brown; antennæ brown on the extreme base, first long joint mostly yellow, its tip and rest of the antennæ nearly black; legs pale yellowish brown; abdomen blackish near tip, very pale yellow on basal part of venter. Wings dark brown, a broad whitish band across near base, and the basal half of the stigma white, rest of stigma nearly black; a pale dot on the forking of the radial sector just behind the stigma, one on the end of the anal vein, and the lower edge of the discal cell hyaline white; veins blackish; hind wings gray, veins darker. Antennæ sparsely hairy, the hairs about twice as long as width of a joint; head with short hairs. Discal cell nearly twice as long as broad at base, base one-half broader than tip, outer side barely concave; stigma nearly angulate behind, the outer side long and sloping. Length 2.7 mm.

From Madeira Mamoré River, Matto Grosso, Brazil (Mann coll.).

Notiopsocus gen. nov.

Related to *Peripsocus* and *Ectopsocus*. Tarsi two-jointed, in fore legs the joints subequal, in the hind legs the basal joint twice as long as the apical joint. Head broad, eyes rather small, ocelli distinct; legs moderately slender. Fore wing with long stigma; median vein near its tip with but one branch, and in some cases this is faint or absent; cubitus simple, not quite reaching the margin; in hind wing the median and radius united for some distance. Type, *N. simplex* sp. nov.

Notiopsocus simplex sp. nov.

Pale yellowish, head and thoracic notum brownish, eyes black, ocelli on black spot; legs wholly pale; wings hyaline; stigma grey, nearly four times as long as broad, with three rows of bristles. Wings hardly reach to tip of abdomen, dorsum of abdomen very soft, venter more chitinous and brown, and two apical rings also more chitinous, the last segment bilobed at tip, and sparsely hairy. Length 1.7 mm.

From Manaus, Amazonas, Brazil (Mann coll.).

EPHEMERIDÆ.

Campsurus dorsalis Burmeister.

A number of specimens of a large species which I identify as this species; I figure the male genitalia; they are similar to those of *C. albiflum* Walk., and perhaps that species is a synonym of *C. dorsalis*. From Camp 41, and 39, Madeira River, Brazil. Described from Brazil. I suspect that *C. pictetii* Kirby is the same species.

Campsurus latipennis Walker.

A few specimens of a small species; I figure the male genitalia which agrees fairly well with the figure of Eaton, the process near base of the long appendage is very slender, the size and marks agree with Eaton's description.

From Camp 41, Madeira River, Brazil. Described from Brazil.

Spaniophelbia assimilis sp. nov.

Head and thorax dark brown; abdomen and legs paler brown; setæ whitish, the basal joint brown, the next short oblique joint almost black; the setæ furnished with many short spine-like hairs, and few very long fine hairs, mostly on the inner side, wings hyaline, veins dark, three radial cross-veins, two medial ones, behind the cubitus is a weak sinuous vein that is connected to cubitus by a cross-vein; by this character it is related to *S. anceps* Eaton, but that species has more cross-veins.

Differs from *S. trilli* Eaton in not having the cubitus forked, and unmarked wing. **Expanse 16 mm.**

From Camp 41, Rio Madeira River, Brazil (Mann.)

***Tricorythus australis* sp. nov.**

Pale yellowish, thoracic notum brown, vertex with a black crescent-shaped mark each side near the eye; pronotum and pleura with some faint blackish spots and sometimes two submedian dark streaks on the mesonotum; abdominal segments blackish on the sides, sometimes all across on the hind margin, the last few segments more broadly marked than the others; legs long and slender, wholly pale; wings moderately broad, subhyaline, subcosta and radius darkened, but few cross-veins and these mostly before the middle of the wing. *Setæ* three, the laterals rather larger than the median, especially in male. Expanse 8 mm.

From Camp 41, Rio Madeira, Brazil (Mann.)

***Bætis oldendorffi* Weyenbergh.**

Three specimens agree with the figure of the fore wing given by Weyenbergh, but that author evidently overlooked the hind wings which are very slender and inconspicuous.

From Camp 41, Rio Madeira River, Brazil (Mann coll.).

PERLIDÆ.

***Neoperla debilis* Pictet.**

**One from Madeira Mamoré River, Matto Grosso, Brazil (Mann).
Described from Brazil.**

***Neoperla posticata* sp. nov.**

Head yellow, with black mark extending forward from between the ocelli, and then bending at right angles to the eyes; antennæ dark; pronotum dark brown, with a broad pale median stripe, widened in front; thorax and abdomen pale yellow; *setæ* dark brown except the basal joint which is yellow; legs blackish, but basal half of fore and middle femora, basal two-thirds of hind femora, and a broad band beyond middle on hind tibiæ, bright yellowish; wings a uniform brown, except the yellowish costal margin. Ocelli about two diameters apart and but little farther from the eyes, lateral bosses close to the ocelli, and about their diameter from the eyes; pronotum much broader than long, slightly narrowed behind, sides strongly rugose; hind tibia longer than hind femur, very broad. Fore wings with two branches to the radial sector; three median and three cubital cross-veins, alternat-

ing. In hind wings also two branches of radial sector, and four cubital cross-veins; in both wings two cross-veins beyond end of the subcosta. Expanse 19 mm.

From Rio Madeira, Abuná, Brazil (Mann coll.).

NEUROPTERA.

SIALIDÆ.

Corydalís nubila Erichson.

Two specimens of this species, of small size, from Porto Velho, Rio Madeira River, Brazil (Mann and Baker).

Common in parts of Northern South America.

CHRYSOPIDÆ.

Chrysopa lanata Banks.

Several from Natal, and Pirangi, Brazil.

Previously known from Argentina.

Chrysopa hybrida Burmeister.

One from Manaos, Amazonas, Brazil (Mann coll.).

Described from Brazil.

Chrysopa sp.

One from Marangape Mts. Ceará, Brazil (Mann coll.). Appears to be new, but is not in good condition; the antennæ beyond base are black, the basal joint with stripe above, pronotum red on side margins, most of cross-veins and the gradate veins black, the inner gradate series much nearer to the outer than to the radial sector.

MYRMELEONIDÆ.

Dimarella efferus Walker.

Three specimens from Abuná, Rio Madeira, Brazil (Mann coll.).

Described from Brazil.

TRICHOPTERA.

ODONTOCERIDÆ.

Marília fasciculata sp. nov.

♂—Spurs, 2-4-2. Dark brown; eyes nearly meeting above, basal joint of antennæ large, slightly swollen in the middle, antennæ whitish, but the joints

broadly banded with black; palpi nearly black, tips of the joints whitish; legs pale brownish, tarsal joints marked with dark brown. Abdomen yellowish brown, the penultimate ventral segment with a black spot; fore-wings nearly uniform brownish, but the stigmal region darker, and outer margin rather darker; hind wings grey with darker veins; at anal angle is a spreading fascicle of long hairs, nearly as long as width of fore wings. Fore wings slender, outer margin nearly truncate, discal cell longer than pedicel, the first apical not so far back on the cell as in *M. minor*; the median vein does not reach outer margin; fork five does not reach as far back as fork one; the hind wings are broad, the anal portion twice as broad as the other part; venation similar to *M. minor*. The male appendages are long, similar to *M. minor*, but the tip enlarged, and a pair of upcurved lateral pieces within the larger appendages. Expanse 19 mm.

From Madeira Mamoré River, Matto Grosso, Brazil (Mann coll.).

MACRONEMATIDÆ.

Leptonema crassum Ulmer.

Camp 43, Madeira Mamoré River, Brazil (Mann and Baker coll.) and Manaos, Amazonas, Brazil (Mann coll.). Known from Brazil, Ecuador, Colombia, and Central America.

Leptonema externum sp. nov.

Pale yellowish white, a dark cloud near the stigma, two black dots near costal base of fore wings and a black dot on outer base of basal joint of each antenna, rest of antennæ faintly annulate; vertex tuberculate near base of antennæ, clothed with fine short hair; third joint of maxillary palpi rather more than one-half the length of the second, much swollen below, fourth joint about one-half as long as third. Wings of moderate length, median cell very broad, fifth apical some distance back on the median cell, discal rather longer than broad. Expanse 25 to 30 mm.

From Camp 41, 360 Kilometers from Porto Velho, Brazil (Mann coll.).

LEPTOCERIDÆ.

Leptocella jenseni Ulmer.

One from Camp 43 Madeira Mamoré River, Brazil (Mann coll.). Although much rubbed it seems to agree with cotypes of this species from Argentine.

Æcetina sp.

One specimen, with the anastomosis strongly marked; not *Æ. excisa*, for fork one is quite long pedicellate.

From Manaos, Amazonas, Brazil (Mann coll.).

HYDROPSYCHIDÆ.

Rhyacophylax lobatus Ulmer.

Many specimens from Manaos, Amazonas; Camp 41, 360 Kilometers from Porto Velho; and Madeira Mamoré River, Matto Grosso, Brazil. (Mann coll.). Previously known from Argentine.

Ecnomodes buchwaldi Ulmer.

Four from Manaos, Amazonas; and Camp 43, Madeira Mamoré River, Matto Grosso, Brazil (Mann coll.). Previously known from Peru; a very distinct and handsome little species.

Cynellus gen. nov.

Differs from *Cyrnus* in having median cell of fore-wings open, and the subcosta runs into radius, or connected obliquely thereto. Type *C. minimus* Bks.

Includes also *Cyrnus risi* Ulmer.

Cynellus minimus sp. nov.

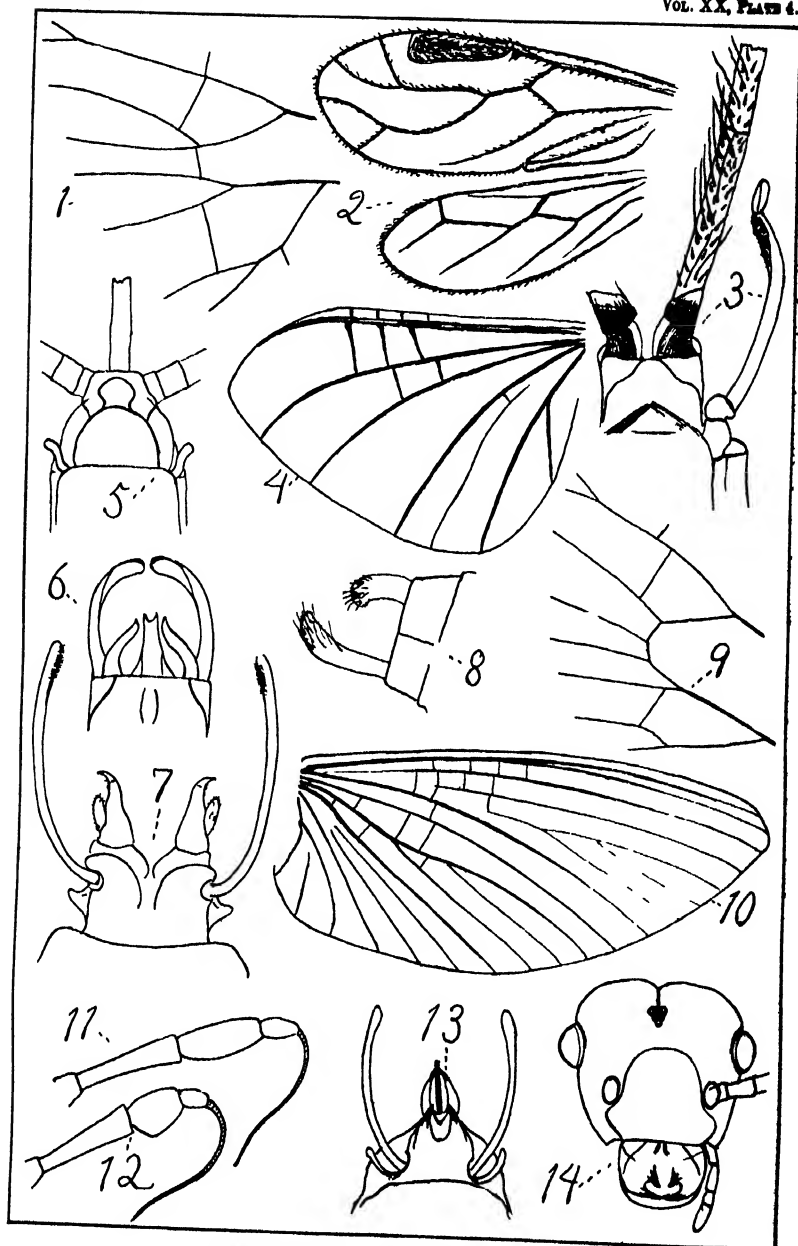
Agrees with *C. risi* in venation, length of cells and forks of both wings. However the wings are of a uniform brown, not darker around outer edge; the lower appendages of the male are not as heavy as in *C. risi* when seen from the side, and the insect is smaller (fore wings hardly 4 mm. long); only apical half of antennæ strongly serrate; the wings are rubbed, but show some scattered golden hairs.

From Camp 41, 360 Kilometers from Porto Velho, Brazil, and Madeira Mamoré River, Matto Grosso, Brazil (Mann coll.).

APPENDIX.

As an appendix I give a table of the species of *Leptonema* known to me; two others are described, one, *L. speciosum* Burm. from Brazil has dark marks on the wings but not near as heavily marked as *L. cinctum*, the other from Southern Brazil, *L. sparsum* Ulmer, has a peculiarity in the venation. I describe one new species from Guatemala, and have yet one other species which appears to be new.

- | | |
|---|------------------|
| 1. Wings with dark streaks all over, leaving hyaline spots..... | <i>cinctum</i> . |
| Wings nearly uniform, or darker only near the stigma..... | 2 |
| 2. Two or three black dots near costal base of fore wings..... | 3 |
| No such dots..... | 5 |



BANKS—NEUROPTEROID INSECTS.

3. A black spot at base of outer side of each antenna; wings whitish . . . *externum*.
No such spot at base of antenna 4
4. Wings brownish, often darker on costal part near stigma, third palpal joint not twice as long as fourth *crassum*.
Wings whitish; palpi more slender, the third joint about twice as long as the fourth *columbianum*.
5. Wings white or greenish white *albovirens*.
Wings more or less brownish 6
6. Fifth apical cell of fore wing reaches well on the median cell 8
Fifth apical cell reaches only to the median cell 7
7. Discal cell long; dots distinct and black *stigmatosum*.
Discal cell hardly longer than broad, dots obsolete *agraphum*.
8. Discal cell hardly longer than broad, outer side very oblique *pallidum*.
Discal cell but little longer than broad, outer side vertical; second palpal joint not one and a half times as long as third *guatemalum*.
Discal cell nearly twice as long as broad; wings long and slender; second palpal joint more than one and a half times as long as the third *furcatum*.

Leptonema guatemalum sp. nov.

Pale yellowish brown, about as in *L. pallidum*; antennæ plainly annulate with brown; vertex flat, with only short hairs; maxillary palpi slender, the second joint hardly one and a half times as long as the third, which is longer than usual, but not much swollen, the fourth not one-half the length of the third. Wings of moderate length, pale yellowish brown, the costal margin not darker, discal cell longer than in *L. pallidum* and the outer margin vertical, fifth apical a short distance on median cell, median cell not very broad. Expanse 30 mm.

From Olas de Moka, Dept. Solola, Guatemala, Sept. (Englehart coll.).

EXPLANATION OF PLATE.

- Figure 1. *Leptonema externum* wing cells.
 2. *Notiopsocus simplex* wings.
 3. *Spaniophlebia assimilis*, genitalia.
 4. *Spaniophlebia assimilis*, fore wing.
 5. *Tricorythus australis*, genitalia.
 6. *Marilia fasciculata*, genitalia.
 7. *Campsurus dorsalis*, genitalia.
 8. *Cyrnellus minimus*, genitalia.
 9. *Leptonema guatemalum*, wing cells.
 10. *Tricorythus australis*, genitalia.
 11. *Leptonema guatemalum*, palpus.
 12. *Leptonema externum*, palpus.
 13. *Campsurus latipennis*, genitalia.
 14. *Notiopsocus simplex*, head.

A NEW SPECIES OF PHORIDÆ FROM NEW ENGLAND.

BY CHARLES T. BRUES.

Bussey Institution, Harvard University.

In a small collection of New England Phoridæ recently given to me for identification by Mr. C. W. Johnson, I have found one large and conspicuous species of the genus *Chætoneurophora*¹ which appears to be undescribed.

Chætoneurophora aureiventris sp. nov.

Length 5 mm. Head and thorax black, abdomen reddish orange, legs honey yellow, wings tinged with brown. Head small, its bristles very large and stout; front less than twice as broad as high, its surface grayish pollinose, with an impressed median line extending from the anterior margin to near the antennal tubercle and widening out above into a depression which fills out the space between the median bristles of the sub-ocular row, and extends above the antennæ as a fine, impressed line; supra-antennal pair of bristles reclinate, stout, approximate at base; row above of four nearly equidistant bristles forming an arcuate line curved down medially; sub-ocular row of four equidistant bristles in a straight line, the lateral ones very near the eye margin. Antennæ oval, moderately large, orange-red, with subdorsal piceous, pubescent arista as long as the width of the head. Post-ocular cilia very large and stout, strongest just above the middle of the eye; cheeks each with a very long macrochaeta at lower angle and a bunch of several short bristles above next to the insertion of the antenna. Palpi orange-red, of ordinary size, beset below with very short bristles with several long ones in addition near apex. Mesonotum and scutellum black, the humeral angles fuscous; one pair of dorsocentral macrochaetæ and four equally stout scutellar bristles; scutellum transverse, nearly twice as broad as long. Pleuræ piceous, lighter below, the propleura fuscous, with a tuft of bristles above the coxa, and elsewhere sparsely clothed with short bristly hairs, several of which at the upper angle are decidedly larger. Mesopleura not bristly. Abdomen reddish orange, the segments subequal, except the sixth which is much elongated. External genitalia piceous, and first segment infuscated above except near the middle; second segment with a tuft of small black bristles on each side, slightly elongated, but not very strongly so. Sides and venter of abdomen entirely orange-yellow. Pleuræ black or fuscous, the amount of black varying from none to nearly the entire pleura. Mesopleura not bristly above. Coxæ and legs brownish yellow or testaceous, hind femora slender, none of the tarsi thickened. Fore tibia with a single bristle at the middle on the outer edge; middle tibia with three bristles, one at end of basal fourth on front side, one at end of basal third on outer side and one on front side just before tip,

¹ Malloch, J. R. The Insects of the Dipterous Family Phoridae in the United States National Museum. Proc. U. S. Nat. Mus., Vol. 43, p. 422, (1912).

in addition to one long terminal spur; hind tibia with three bristles, one at basal third on outer edge, one just before middle on the front side and one just before tip on front side in addition to two apical spurs: in addition the hind tibia is transversely striated on the hind (i. e., inner, as the leg folds next to the body) side near tip. Wings yellowish, the veins yellowish brown: costa not thickened, reaching almost two-thirds the length of the wing, its bristles very short and dense; third vein very finely bristly as far as the fork; first vein ending midway between the humeral cross-vein and the tip of the third; second vein lying very close to the third, from which it emerges at a very slight angle; fourth vein curved strongly at base but straight beyond and faintly recurved at apex, ending at the wing tip; fifth and sixth slightly sinuous; seventh distinct. Halteres clear yellow.

Described from three females sent to me for identification by Mr. C. W. Johnson. Type from Kingston, R. I., May 7, 1905. Paratypes: Riverside, Mass., May 20, 1905; Hampton, N. H., May 16, 1905 (S. A. Shaw). Type in the collection of the Boston Society of Natural History.

This species resembles *C. variabilis* Brues from Colorado and Washington more closely than any other described species and may possibly be only a well-marked form of *variabilis*. However, the halteres are pale, there is much more of the orange color on the abdomen, and there are only two supra-antennal bristles. From *C. thoracica* it differs by the non-thickened costa and from other related species in the chaetotaxy of the tibiae.

MUSCOID PARASITES OF THE COTTON-STAINER AND OTHER LYGÆIDS.

BY CHARLES H. T. TOWNSEND.

Lima, Peru.

The only muscoid parasites of *Lygæidæ* so far known in any stage have come to light in Sicily and Peru. The number of species has now reached four, one of which has been reared to the adult. The finding of these may be taken in chronologic order.

1) Neilsen mentions finding what was probably a muscoid maggot (*Snylteflueart*) in the abdomen of an adult of *Lygæus saxatilis* Scop. in Sicily. The fly was not reared. The species may have been a *Clytiomyia* (recorded from Sardinia), *Eliozeta*, or *Elomya* (*Ananta*), less likely a *Xysta*, *Cistogaster*, or *Besseria*.

2) The next finding of muscoid maggots in *Lygæids* was by

the writer at Piura, Peru. Three maggots were found in adults of *Stenomacra* sp. near *limbatipennis* Stal, July 27 (one in 3rd stage), and July 28 (one in 2nd, and one in 1st stage), 1911. In each case one maggot occurred alone in the abdomen of the host. On August 19, 1911, a dried puparium of the same species was found in the contents of a box in which adults of this host had been placed on August 1. The fly was not reared. The species is almost certainly *Xanthomelanodes peruanus* Towns., which is very abundant in the Piura valley, as is likewise the host.

Anal stigmata of third-stage maggot and puparium—The anal stigmatal plates are rather narrowed, not as broad as long, closely approximated, well raised as on a short process; the three slits are ridge-like, disposed at about $22\frac{1}{2}^{\circ}$ angle to the long (dorso-ventral) axis of the plates, rather elongate, sharp, well raised.

3) On February 3, 1911, the writer collected 817 adults of *Dysdercus ruficollis* Linné on cotton in the Chira valley between Sojo and Macacará, picking and putting in with them at the time some opened cotton bolls and keeping them alive in a fine-screened wooden cage as long as they would live on mashed moistened cottonseed, in the hope of securing parasites. This species is the common cotton-stainer of the Peruvian coast region. No sign of muscoid parasitization was obtained from the lot other than the finding on February 10 of a small muscoid puparium in the lint of one of the opened cotton bolls that had been put in the cage February 4. This puparium had transformed from a maggot that had evidently escaped from a stainer to the lint of the opened boll before collection. The puparium proved to be parasitized, a *Perilampus* sp. issuing from it on March 2, 1911. Mr. H. S. Smith's recent investigation of the planidium stage of *Perilampus* shows that it enters the muscoid maggot while the latter is still *in situ* within the body of its host. This explains the finding of the present parasitized puparium within a cage which the adult of *Perilampus* could not have entered. The hyperparasite was determined by Mr. J. C. Crawford. The puparium was probably that of *Acaulona peruviana* n. sp. It was sent in with the reared hyperparasite.

My assistant, Mr. E. W. Rust, had better success in rearing the fly in 1912. From 594 adults of *D. ruficollis* collected at various dates during the last week of September and the first week of Octo-

ber at San Jacinto in the Chira valley, a little below Macacará, there issued on October 29, 1912, two flies, a male and a female, of *Acaulona peruviana* n. sp.

Acaulona peruviana sp. nov.

Length of body, about 7 mm.; of wing, about 6 mm. Light yellow to tawny yellow and deep golden. Face including parafacials silvery, with a golden sheen; that of male hardly more golden than that of female. Parafrontals deep gold in both sexes, frontalia dark brown to blackish. Antennæ and palpi yellowish, former tinged with brownish on front edge. Occiput golden. Thoracic scutum broadly deep gold on borders and transverse suture, leaving the four broad subcoalescent vittæ in two patches of blackish before and behind suture; the parts of vittæ in front of suture more distinctly defined, especially in the male, of which the outer are shorter and broader, and well separated from the inner. Scutellum of female dusky, narrowly yellowish on tip; that of male more yellowish, basal half or less dusky. Pleuræ and coxæ silvery, with golden tinge. Abdomen of female rather tawny yellowish to gold, that of male bright light yellow in a well-defined elongate area on each side; irregular soft brownish median fascia, its sections widening posteriorly on hind margin of each segment, usually more conspicuously so in female; last two segments (5 and 6) of female and last segment (6) of male wholly yellowish; fifth segment of male largely dusky. Abdomen of male narrowed and flattened, elongate; that of female widened, swelling on sides, arched. No true abdominal macrochaetæ, but the hairs of male in some cases simulate them. Femora largely yellow, the front ones least so and quite blackish above, the hind ones dusky only on tip; rest of legs blackish. Tegulæ yellow to golden, especially on disc. Wings blackish on less than costal one-half, abruptly subhyaline on rest; apical cell clear except sometimes on front margin and tip, closed in margin.

This species seems more closely related to *A. tehuantepeca* Towns. than to *A. costata* v.d.W.

Described from two reared specimens, male and female, San Jacinto, Chira valley, Piura department, Peru, issued October 29, 1912. These types will be deposited in the U. S. N. M. The species is comparatively rare, only five specimens having been collected by the writer in Peru during three years, these being four females and one male as follows:—One female, Somate, Rio Chira, November 18, 1910, on flowers of *Telanthera* sp.; one male on foliage, Chapairá, Rio Piura valley, May 21, 1911; two females, Cañada de Samán, Chira valley, February 14, 1912, on flowers of *Philibertella flava*; and one small female (about 5 mm.), Sullana, Chira valley, February 17, 1912, on foliage.

This species will be difficult to distinguish from *Xanthomelanodes peruanus* until one becomes familiar with the generic and specific

characters of the two forms. *X. peruanus* has short but pronounced abdominal macrochætæ, abdomen subcylindrical in male and nearly same but shorter in female, the black of wings graduates into the subhyaline, the femora are blackish, the face golden especially in male, the abdominal triangles are shining blackish to black, the tegulæ are pale yellowish to whitish, the scutellum wholly black and thoracic vittæ more clearly defined. *Acaulona* shows the distinctive facies of the *Trichopodiæ* in the male sex, and rather that of the *Polistomyiæ* in the female sex, only lacking the cilia of hind tibæ.

Puparium—Rather short-stout in form, swollen. The anal stigmatal plates are broad, contiguous, closely approximated, each nearly as broad as long, not raised; the three slits are ridge-like and obliquely disposed, being at about 45° angle to both axes of the plates, rather short and sharply linear, a very little raised, their bases swelling.

(4) From the same lot of 594 adults of *D. ruficollis* there was also found issued October 29, 1912, with the above two specimens of *A. peruviana*, a third puparium still containing the fly and supposed by Mr. Rust to belong to the same species. It proves to be an entirely distinct genus from both *Acaulona* and *Xanthome-lanodes*. The fly has not issued, and the contents are probably dried. The anal stigmata are well produced and prominent, approximated, and the three slits or divisions of each are swollen tuberculate instead of linear ridge-like.

Puparium—Length about 6 mm., being about the length of the *Acaulona* puparium but not so swollen. Anal stigmatal plates produced into a rather high process, height about equal to long axis of plate or dorsoventral diameter, each plate rather narrowed, the two approximated but not actually contiguous; the three slits appear tuberculate by reason of their greatly swollen bases, each plate presenting the appearance of three rounded divisions, the axis of slits at about 45° angle to both axes of plates, the slits themselves apparently irregularly compressed-sinuate.

THE GENUS PHRYGANEA (TRICHOPTERA) IN THE FLORISSANT SHALES.

BY T. D. A. COCKERELL.
The University of Colorado.

If it receives anything like the treatment it deserves, Ulmer's magnificent work, *Die Trichoptera des Baltischen Bernsteins*, will create much new interest, not only in the Trichoptera of amber, but in the general history and classification of the group. Among other things, it shows that as far back as the oligocene in Europe the genus *Phryganea* was very well represented, no less than seven species having been discovered in amber. When we consider that only 20 or 21 recent species are known in the world, it appears probable that in mid-tertiary times it was considerably richer in forms than at present; but the modern *Neuronia*, with quite numerous species, may be taken to represent an offshoot from the *Phryganea* of the tertiaries, some of the fossil species possessing more or less evident *Neuronia*-like characters.

In the Miocene shales of Florissant Colorado, *Phryganea* is represented, so far as at present known, by two species. One of these was long ago described by Scudder; the other is new. In addition, Scudder described a *Neuronia evanescens*, but its reference to *Neuronia* is doubtful. No definite idea of its venation can be gained from Scudder's figure, but his description is more explicit. Vein R_2 leaves the discoidal cell "close to the base," a condition approached by the amber species *Phryganea longirostris* Hagen. On the other hand the discoidal cell is comparatively short, as is usual in *Neuronia*, while the R-M cross vein is "widely separated" from the end of the discoidal cell, that is, considerably beyond it; an approach to the latter condition is shown by the amber species *P. egregia* Ulmer and *P. picea* Pictet. An exact drawing of the venation of *N. evanescens*, based on Scudder's type, is much to be desired.

Phryganea labefacta Scudder.

I have before me a very well preserved anterior wing, collected by my wife at Station 17. It is $19\frac{1}{4}$ mm. long, and a little over $7\frac{1}{2}$ broad; the discoidal cell is $6\frac{1}{2}$ mm. long; end of discoidal cell

to apex of wing 7 mm.; length of cellula thyridii 7 mm. In some ways, this species is suggestive of *Neuronia*. Scudder's figure shows a distinct mottling, suggestive of *N. pardalis* Walker, but the apex of the wing is much blunter than in *pardalis*. In shape, the wing is more like that of *N. ruficrus*, but the apical part of the costa is not so rounded as in that insect, and the anal angle is rather more distinct. The wing-form of *P. labefacta* is not unlike that of the amber *P. longirostris* Hagen, but our insect has the costa much straighter, the anal angle more distinct, and the wing hardly so broad in proportion to its length. The comparatively distinct anal angle is as in the amber *P. singularis* Ulmer.

Phryganea miocenica sp. nov.

A very fine species, collected by one of the University of Colorado expeditions, but the collector and station are not recorded. It is represented by an upper wing, very well preserved except for the loss of a considerable part of the region of the anal angle. It appears to represent a female, and is a quite typical *Phryganea*, with relatively long wings.

Upper wing about 24 mm. long, 9 wide, as preserved red-brown, the costal region broadly darkened, the anal region dusky, the veins dark on a lighter ground. Owing to the dark costal cell, the oblique cross-vein between the costa and subcosta cannot be clearly demonstrated, but a kink in the subcosta indicates its point of origin. The discoidal cell is about $7\frac{1}{2}$ mm. long, cellula thyridii 9 mm.; apex of wing to base of discoidal cell slightly over 16 mm.

Compared with the female of the amber *P. latissima* Ulmer, there is close agreement in venation, though our insect is much longer-winged than *latissima*, yet not so long (narrow) winged as *P. dubia*. Compared with *P. latissima*, the second anal cell of *P. miocenica* is longer and narrower, its lower side more convex; the cellula thyridii is longer and narrower; the apical angle of the discoidal cell is much more acute. The lower branch of the media forks is in ♀ *latissima*; owing to the loss of part of the wing, only the extreme base of the fork is visible.

This is the largest of the Florissant Trichoptera, and is considerably larger than any of the amber species of *Phryganea*.

PSYCHE

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A STUDY OF THE CLUSIODIDÆ, (HETERONEURIDÆ) OF THE EASTERN UNITED STATES.

BY CHARLES W. JOHNSON.

Boston Society of Natural History.

Since the publication of the "Revision der Heteroneuriden" by P. Leander Czerny (Wien. Ent. Zeit. XXII, 61, 1903), it has been apparent to the writer that there were many discrepancies and errors in the determination of the American species. The want of material, however, has caused me to hesitate in attempting to define our species more clearly. It seems imperative that these errors should be corrected and brought to the attention of future workers.

The species seem to separate quite readily into the genera described by Czerny and Coquillett, based on the arrangement of the cephalic bristles, and later tabulated by Dr. Williston in his "Manual of North American Diptera."

Clusiodes Coquillett.

For the genus *Heteroneura* Fallen 1823, not 1810, Coquillett proposed the genus *Clusiodes* 1904, Type *H. albimana* Meigen. The four species belonging to this genus may be tabulated as follows:

1. Wing with the clouding on the anterior portion confined to the apical third . . . 2
Wing with the clouding extending from the end of the first vein *geomyzina* Fall.
2. Legs with the anterior tarsi more or less black 3
Legs entirely yellow; face of the ♂ black *melanostoma* Loew.
3. First, or the first two anterior tarsal joints black, the others white

albimana Meig.

All of the anterior tarsal joints in the ♀ and the last three or four joints in the ♂ black *pictipes* Zett.

Clusiodes geomyzina Fallen.

Heteroneura geomyzina Fall., Agromyz. 2. 2. 1823; Czerny, Wien. Ent. Zeit., XXII, 77, Taf. I, f. 1, 2 and 4, 1903.

One specimen was taken by the writer at Machias, Me., July 19, 1909, the first American record.

Clusiodes melanostoma Loew.

Heteroneura flavifacies Coq. ms. in Mrs. Slosson's List of Mt. Washington Insects, Ent. News, VIII, 239, 1897, not "Smith's New Jersey Cat.," as stated in Aldrich's Cat., p. 570.

The fourteen specimens before me show the following distribution: Maine—Northeast Harbor, July 12 (Dr. C. S. Minot) and Machias, July 19, 21 (C. W. J.); New Hampshire—Franconia and Mt. Washington (Mrs. Slosson); Vermont—Norwich, July 7, and Mt. Ascutney, July 11; Massachusetts—Auburndale, June 15, 21, Mt. Greylock, June 15, and Chester, May 26, 28 (C. W. J.); Montreal, Can., July 14, (Beaulieu).

Clusiodes albimana Meigen.

Thirteen specimens show the following distribution: Maine—Capens, Moosehead Lake, July 14 (C. W. J.); New Hampshire—Intervale, August 23 (G. M. Allen); Vermont—Burlington, June 24, St. Johnsbury, July 28, Norwich, July 8, Mt. Ascutney, July 11, and Manchester, June 4; Massachusetts—Washington, August 8, Bash Bish Falls, June 27 (C. W. J.); New Jersey—Delaware Water Gap, July 12; Canada—Rouville County, Quebec (G. Chagnon).

Clusiodes pictipes Zetterstedt.

Mt. Washington, N. H., Coquillett in Mrs. Slosson's List of Mt. Washington Insects (Ent. News, VIII, 239, 1897). The occurrence of this species in North America is somewhat doubtful.

Heteromerangia Czerny.

The following species, placed under this genus, are distinguished by the absence of frontal cross bristles. The four species may be separated by the following table:

1. Species in which yellow predominates. 2
Species entirely black. 3
2. Thorax entirely yellow, cephalic bristles yellowish. *flaviseta* sp. nov.
Thorax with a large black lateral spot or stripe, cephalic bristles black
latifrons Loew.
3. Anterior legs entirely yellow, posterior femora and tibiae annulated; wing clouded beyond the end of the fifth vein. *annulipes* sp. nov.
Anterior tibiae and tarsi, and apical half of the femora black; wing clouded before the end of the fifth vein. *nitida* sp. nov.

Heteromeria latifrons Loew.

Heteroneura latifrons Loew., Wien. Ent. Monatssch., IV, 82, 1860.

Twelve specimens show the following distribution: Massachusetts—Auburndale, August 13, Weston, July 23, Chester, August 7; New Jersey—Delaware Water Gap, July 15; Pennsylvania—Lake Ganoga, North Mt., August 29.

Heteromeria flaviseta, sp. nov.

Female: Face, cheeks and lower half of the occiput whitish, front and upper half of the occiput light yellow, antennæ and a space above their base, fulvous yellow, arista blackish; frontal and vertical bristles yellowish. Thorax, scutellum, and metanotum yellow, humerus, pleura and coxæ white. Abdomen yellow, the tip of the fourth, all of the fifth, and the dorsal portion of the sixth segment, brownish black, tip of the last segment margined with white, ovipositor yellow. Halteres and legs yellowish white. Wings yellowish hyaline, apical third slightly clouded, especially near the veins. Length 4 mm.

Two specimens. Holotype, New Brunswick, N. J., May 28 (Dr. J. B. Smith). Paratype, Ft. Lee, N. J. Types in the author's Collection.

Heteromeria annulipes sp. nov.

Face and cheeks white, lower part of the front and orbits yellow; upper part of the front, the vertex and occiput black, palpi and antennæ yellow, apical half of the third joint and arista dark brown. Thorax, upper half of the pleura, scutellum, metanotum, and abdomen, shining black; lower half of pleura, legs and halteres yellowish white; tip of the posterior femora and tibiæ annulated with dark brown. Wings hyaline, apical third, and a small area at the anterior cross-vein, and end of the discal cell, slightly clouded with smoky black. Length 3 mm.

One specimen, Murfreesboro, Hertford County, N. C., June 9, 1895. Type in the author's collection. This species resembles *Heteroneura flavipes* Will., but the annuli on the posterior legs and the apical clouding of the wing, which is entirely beyond the end of the fifth longitudinal vein, readily distinguish the species.

Heteromeria nitida sp. nov.

Male: Face yellowish, orbits whitish pruinose, cheeks shining black; front black, opaque, vertex shining; antennæ yellowish, tip of the third joint and arista dark brown. Thorax dull black, pleura and abdomen shining black; legs yellow, the anterior legs except the coxæ and basal half of the femora, black, base and tip of the posterior tibiæ dark brown. Halteres white. Wings smoky, darker along the anterior portion beyond the middle and near the cross veins. Length 3 mm.

The female differs but little from the male except that the front is entirely shining black. Length 3.5 mm.

Three specimens. Holotype and allotype from Goose Neck, near Long Branch, N. J., June 12, 1902. Paratype, Riverton, N. J., May 14. All are in the author's collection.

In the "Insects of New Jersey" this was erroneously referred to *Heteroneura pictipes* which it resembles superficially and, barring the absence of the frontal "cross bristles," agrees fairly well with the description of that species. It is also closely allied to *Heteromerhingia nigricanana* Loew. but the shining black cheeks and white halteres seem to separate it from that species.

Clusia czernyi sp. nov.

Male: Upper half of the face black, orbits and lower half including the cheeks, white, proboscis and palpi white, front yellow, antennæ light yellow, arista and ocelli black. Thorax yellow, pleura with a wide, black, shining stripe extending from the neck to the base of the abdomen, the rest of the pleura and sternum yellowish white. Abdomen yellow with wide lateral stripes of black. Legs yellowish, base of the femora and the coxæ white, base of the posterior tibiæ brownish, halteres white. Wings grayish hyaline, with a middle and apical band of black, broadly connected by a band filling all of that portion of the marginal and submarginal cells. Length 5 mm.

Female: Face yellow with two black stripes extending from the base of the antennæ to the oral margin, tips of the palpi black. The broad lateral stripes of the abdomen are interrupted at the fifth segment. Ovipositor yellow. Length 6 mm. In other respects resembling the male.

Seventeen specimens. Holotype and allotype, Northeast Harbor, Me., July 1, 1909 (Dr. Charles S. Minot). In the collection of the Boston Society of Natural History. Paratypes, Northeast Harbor, Me., June 3, July 4, 19 and 23 (Dr. Minot), Eastport, Me., July 15, Mt. Equinox, Vt., June 5, Chester, Mass., May 25 and 27, and North Mt., Pa., June 8, 1898 (C. W. Johnson); Franconia, N. H. (Mrs. A. T. Slosson); Holland, N. Y., May 21 (M. C. Van Duzee); Sport Island, Sacandaga River, N. Y., June 16, 1910 (C. P. Alexander).

This species has been confused with *C. lateralis*, from which it can be readily separated by the double banding of the wings and the broader and more continuous lateral abdominal stripes. Both species have a similar distribution but *C. lateralis* usually appears somewhat later in a given locality. At Chester, Mass., *C. lateralis* was common in August but was not observed in May.

Clusia lateralis Walker.

Heteroneura spectabilis Loew., Wien. Ent. Monatschr. IV, 82.

The nineteen specimens before me show the following distribution: Maine—Northeast Harbor, July 4 (Dr. C. S. Minot); Vermont—Norwich, July 7, Burlington, June 23, and St. Johnsbury, June 27; Massachusetts—Auburndale, August 9, Chester, August 4–7, and Bash Bish Falls, June 27; Connecticut—Middletown, June 19; New Jersey—Riverton, July 6; Pennsylvania—Folsom, June 12, and Glenside, May 26 (C. W. Johnson); Canada, (Beaulieu), July 16.

Chætoclusia affinis sp. nov.

Male: Head light yellow, palpi and antennæ yellow, arista black, densely plumose, ocelli black. Thorax yellow, abdomen brownish, tip yellow. Legs yellow, anterior tibiæ and tarsi brown. Halteres yellow. Wings yellowish hyaline. Length 2.5 mm.

Female: Similar to the male except that the anterior tibiæ and tarsi are black and the abdomen shining with an obscure dorsal line and black tip. Length 3 mm.

Holotype, Riverton, N. J., June 18 (C. W. J.); allotype, Jamesburg, N. J., July 15 (J. B. Smith). Both in the author's collection.

The Jamesburg specimen was referred doubtfully to *Clusia flava* Meig. in Smith's Insects of New Jersey. The Fort Lee specimen also referred to that species is *H. flaviseta*. As this is the only American record for *C. flava*, it should be omitted from the list of North American Diptera.

ON THE TRIBE DEJEANIINI OF THE MUSCOID FAMILY HYSTRICIIDÆ, WITH FIVE NEW GENERA.

BY CHARLES H. T. TOWNSEND,
Director of Entomological Stations, Lima, Peru.

The Dejeaniine flies are among the most striking and interesting of the muscoid group. They are characterized not only by a general strong macrochætal development showing in more or less densely placed spines on the abdomen and scutellum, which they share with many other forms of the *Hystriciidæ*, but also by the unique development of the palpi which are greatly elongated.

The tribe as so far known to the writer divides naturally into the four subtribes *Dejeaniina*, *Paradejeaniina*, *Lasiopalpina* and *Dejeaniopina*, the last three being monotypic. Only the last two have pilose eyes. The *Dejeaniina* divide into three group-units, the *Dejeaniinæ* with discal spines on intermediate abdominal segments and normal palpi, the *Eulasiopalpiæ* without discal spines and with ciliate palpi, and the *Eudejeaniinæ* without discal spines and with normal palpi. *Dejeania* was founded by Robineau Desvoidy in 1830, who included therein at the time the two species *brasiliensis* RD. and *capensis* RD., but without designating either as the type. In 1910 Coquillett designated the latter, which equals *Stomoxys bombylans* F., as type of the genus. *Lasiopalpus* was founded by Macquart in 1847, with the single species *flavitaris* Mcq. which is thus the type. *Eudejeania* was founded by the writer in 1912, with designation of *subalpina* T. as type.

All the Dejeaniine flies known up to twenty years ago, other than *Lasiopalpus*, were grouped under the single genus *Dejeania*. Brauer and von Bergenstamm were the first to cut any of the forms loose from this combination, characterizing the genus *Paradejeania* in 1893 for *Dejeania rutilioides* Jaenicke and *Jurinia myrrhea* Say, BB. As the latter is a *momen nudum*, the former stands as the type of the genus. In 1898 Brauer added to the genus, *Jurinia hystrix* Riley (nec F., nec Will.) MS from North America, *Jurinia amethystina* Macquart from Brazil (Minas-Geraës), *Jurinia bicolor* Macquart (nec Wd.) from Colombia and Cayenne (two species, probably MS in coll.), *Jurinia nigricalyp-*

trata Macquart from Brazil (Minas-Geraës), and *Hystricia erythrina* Bigot from Brazil (Bahia). The remainder of the forms continued under the old genus until 1912, when the writer established the genus *Eudejeania* for certain strikingly large and distinct forms which range high in the Andean montanya.

The African *Dejeania capensis* RD. (equals *bombylans* F., Wd.) is not congeneric with any of the American forms, hence its designation as type of the genus leaves the latter without nearer generic reference than *Eudejeania*, which is strikingly contrasted with the older and better known forms. The figure 21, on page 44 of the third edition of Dr. Williston's Manual, labeled *Paradejeania* sp., is evidently not that genus. It has almost exactly the form and aspect of *Eudejeania* female; if discal spines are wanting on the intermediate abdominal segments (they appear to show on the left side of second segment), and the proboscis and palpi are both very elongate, it is probably *Eudejeania*. The figure 60, on page 366 of same work, also labeled *Paradejeania* sp., is neither *Paradejeania* nor *Eudejeania*, but has the palpal characters of *Jurinia*.

Tachina armata Wiedemann was taken by Brauer and von Bergenstamm in 1889 as typical of the American forms, and is here made the type of the new genus *Adejeania*. *Tachina corpulenta* Wiedemann and *Dejeania vexatrix* Osten Sacken are strikingly contrasted with *Adejeania* and the other American forms, the second showing an approach to *Servillia* in its long dense pubescence and the first exhibiting bristles in place of this pubescence. Both are made the types of new genera. *Eulasiopalpus* is erected for forms with ciliate palpi, long proboscis and bare eyes. The following synoptic table will show the distinctions between all of these forms with greatly elongated palpi, including the new genus *Dejeaniops* Townsend whose characterization is given in full in a forthcoming paper on the *Hystriiidae* of the Andean montanya.

Table of Tribe Dejeaniini.

1. Eyes thickly pilose, third antennal joint straight on front border and widened-subtruncate apically. 2
- Eyes practically bare, third antennal joint more or less convex on front border and always rounded apically. 3
2. Palpi long and narrow, of even width except on the more narrowed base, not ciliate; proboscis elongate and slender; parafacials hairy; abdomen subovate and gently emarginate anally, no discal spines on intermediate segments; front

tarsi of female not conspicuously widened (Dejeaniopina)

Dejeaniops gen. nov.

Palpi much widened on apical half, gradually narrowing basally, densely ciliate with long hair; proboscis short and stout; parafacials bare; front tarsi of female strongly widened (Lasiopalpina).....*Lasiopalpus* Mcq.

3. Palpi narrow, gradually narrowing basally, ciliate with long hair; proboscis slender and conspicuously longer than head-height; parafacials hairy; abdomen emarginate anally (Dejeaniina: *Eulasiopalpiæ*)... *Eulasiopalpus* gen. nov.
Palpi not ciliate.....4

4. Palpi gradually widened from base distally, proboscis short; abdomen subquadrate and conspicuously emarginate anally; front tarsi of female strongly widened (Paradejeaniina).....*Paradejeania* B. & von B.

Palpi of even width on distal two-thirds or more; proboscis elongate and slender (Dejeaniina: *Dejeaniinæ* and *Eudejeaniinæ*).....5

5. Discal spines on dorsum of intermediate abdominal segments (*Dejeaniinæ*)
Dejeania R.D. (Africa)

No discal spines (*Eudejeaniinæ*).....6

6. Abdomen subquadrate and deeply emarginate or buttocks-like behind in both sexes; front tarsi of female widened.....*Eudejeania* T.

Abdomen subovate, not broadly buttocks-like behind, at most the hind border of anal segment half as long as greatest width of abdomen and gently emarginate in female; front tarsi of female not widened.....7

7. Abdomen clothed with strong bristles in addition to the spines and differentiated therefrom, front tarsi of male with bristly hairs on inside

Echinotachina gen. nov.

Abdomen with only pubescence in addition to the spines.....8

8. Pubescence short and normal.....*Adejeania* gen. nov.

Pubescence long, dense, even and pronounced, showing conspicuously among the spines, thorax also with a dense pubescence.... *Trichodejeania* gen. nov.

Below is a statement of the genera and their types. Whether all these forms belong in one natural tribe remains to be decided by a careful intensive study of the group and its allies. Although it would seem probable that these elongate palpi are not all of common origin, yet none of the forms exhibits any striking departure in its external anatomy from the general characteristics of the group. A comparative study of the first-stage maggots, which the writer has in hand, will conclusively demonstrate the actual affinities.

DEJEANIA R. D. (1830)—Type, *Stomoxys bombylans* F. (equals *Tachina bombylans* Wd., and *Dejeania capensis* R.D.).

LASIOPALPUS Mcq. (1847)—Type, *L. flavitarsis* Mcq.

PARADEJEANIA B.B. (1893)—Type, *Dejeania rutilioides* Jaen.

EUDEJEANIA T. (1912)—Type, *E. subalpina* T.

DEJEANIOPS T. gen. nov.—Type, *D. ollachea* T. n. sp.

EULASIOPALPUS gen. nov.—Type, *Lasiopalpus albipes* T. n. sp.

ADEJEANIA gen. nov.—Type, *Tachina armata* Wd. (equals *Dejeania armata* BB.).

TRICHODEJEANIA gen. nov.—Type, *Dejeania vexatrix* O.S.

ECHINOTACHINA gen. nov.—Type, *Tachina corpulenta* Wd.

The following descriptions are abridged from the originals which will appear in the forthcoming paper on the *Hystriciidæ* of the Andean montanya.

Dejeaniops ollachea sp. nov.

Length, 11 mm. One female, Ollachea, San Gaban canyon, southeastern Peru, about 9,500 ft., Feb. 2 (Townsend). Head yellowish, faintly golden. Palpi rust-yellow, antennæ yellowish-brown to reddish, arista black. Parafrontals and thorax brownish-olive, scutellum pale. Abdomen soft black, with clear light yellow on sides of anterior two-thirds. Legs rust-yellow, femora largely blackish. Wings and tegulæ smoky, tegulæ thickly microscopically black-pubescent. Palpi and proboscis both very long and slender, parafacials and eyes pilose.

Lasiopalpus albipes sp. nov.

Length, 14 mm. One male, Huascaray ridge, northern Peru, about 7,000 ft., Sept. 22 (Townsend). Head smoky-silvery; epistoma, front, antennæ and palpi black or blackish. Thorax, scutellum, abdomen and femora black, tibiæ pale yellowish, tarsi yellowish-white. Wings infuscated, tegulæ smoky-black. The third antennal joint is rounded apically, eyes bare, parafacials hairy, and proboscis about one and one-fourth times head-height.

The following are descriptions of two new species of *Eudejeania* recently secured by the writer in the high Andean region of central Peru:—

Eudejeania punensis N. sp.

Length of body to ends of spines, 14 to 16 mm.; of wing, 11.5 to 13.5 mm.; of palpi, 3.5 to 4 mm.; width of abdomen, 7 to 8 mm. Fifty-two females and one male, Pachacayo valley, about 12,000 feet, in puna region about half way between Oroya and Jauja, Peru, March 27 and 28, 1913, on flowers of *Viguiera*-like composite. The immense preponderance of the females is worthy of remark.

Differs from *Eudejeania nigra* T. by its much smaller size and by the following colorational characters:—Legs with their spines, palpi and first two antennal joints rust-yellow, the second antennal joint more or less slightly smoky on base. Wings only lightly smoky, the veins rust-yellow giving the wing bases a distinct yellow tinge. Parafrontals dusky olive. Occipital pile pale brassy. Thorax and abdomen dark brown to black, showing smoky pollinose on anal segment in oblique view and somewhat less so on third segment.

Type, TD4135 (female fly, reproductive system, first-stage maggot). Has strap-like uterus and deposits blackish maggots, probably on foliage.

Eudejeania alpina n. sp.

Length of body to ends of spines, 20 mm.; of wing, 16.5 mm.; of palpi, 5 mm.; width of abdomen, 11 mm. Two females, Pachacayo valley, about 12,000 feet, with preceding species on same flowers, March 28, 1913.

Differs from *Eudejeania punensis* T. by its much larger size and by the following colorational characters:—Head deeply fuscous, practically black, only narrow orbits and wider border in front of eyes brassy. Antennae wholly black. Frontalia silvery to tawny pollinose in oblique view. Palpi yellowish or tawny, but deeply tinged with smoky. Occipital pile golden to brassy. Wings deeply smoky throughout including bases; veins brown to blackish, not showing yellowish to the unaided eye. Legs slightly deeper rust-yellow, the femora more reddish.

Type, TD4139 (female fly, reproductive system).

It should be noted here that the writer, in all of his collecting, has never before found such an abundance of Dejeaniine flies in the height of activity as that encountered at the above-mentioned locality in Pachacayo valley, forty-five of the above specimens having been taken there in an hour or so of fitful sun and rain during the forenoon of March 28. Hundreds of *E. punensis* could doubtless have been collected in the locality had sun and time permitted. An approach to such abundance, but in a state of dulled activity, was encountered in October, 1895, in the Sacramento Mountains of southern New Mexico (Ann. & Mag. N. H., 6th ser., vol. 19, No. 110, pp. 144-145).

A NEW BEE OF THE GENUS EMPHOR.

BY T. D. A. COCKERELL,

University of Colorado.

Mr. C. T. Brues has kindly sent me three females of a species of *Emphor*, collected by Miss Louise Nichols at Cape May Pt., N. J., Aug. 25, 1912. To my surprise, they are not *E. bombiformis* but represent a new species.

Emphor fuscojubatus sp. nov.

♀. Like *E. bombiformis* (a cotype from Georgia compared) but differing as follows: hair of vertex dark rufouscous, instead of being ochreous like that of the thorax; hair of thorax paler, not so red; hair of middle of front fuscous instead of whitish; scape not red at apex; third submarginal cell conspicuously longer; hind margin of first abdominal segment narrowly pale and pellucid; wings perhaps rather paler.

This is probably the *Emphor bombiformis* of Smith's New Jersey list.

SOME OBSERVATIONS ON THE NESTING HABITS OF
THE MINING BEE, *EMPHOR FUSCOJUBATUS* Ckll.

BY M. LOUISE NICHOLS.

These observations were made during the last week of August, 1912, at Cape May Point, N. J., by Mr. Reynold A. Spaeth and myself. The bees collected were thought at first to be *Emphor bombiformis* Cress., but a closer examination by Prof. T. D. A. Cockerell revealed the fact that they were sufficiently unlike *E. bombiformis* to be classed as a new species, named by Prof. Cockerell *Emphor fuscojubatus*, and differing from the other species chiefly in the color of the hair on various parts of the body and in the greater size of the third submarginal cell of the wing. It is a member of the family Apidæ.

By the side of a road, for a distance of about one eighth of a mile, in soil consisting of a mixture of clay, sand and pebbles, numerous nest openings were discovered and between about ten A. M. and four P. M. many bees flying in and out. The nest is begun as a semicircular depression, the soil being moistened by a fluid from

the mouth, loosened by the mandibles, and ejected sidewise by the first and second pairs of legs. As the depression increases in depth, it is surrounded by a wall of the moistened earth, reaching a height of about one centimetre, the posterior end of the abdomen being used as a trowel in its construction.

At frequent intervals the bee stops work, and after an absence of thirty seconds or so, returns. Our curiosity aroused as to the reason for these frequent excursions, we followed one individual in her flight and were led to a small pond about seventy-five yards away. Here numerous bees were discovered floating on the surface with legs outstretched, presumably sucking up into their crops a supply of water for use in making the nest. By its aid the clayey soil is formed into pellets, passed under the body probably by means of the tibial spines and kicked out at the entrance by a sudden jerk of the last pair of legs, most comical in the impression it produces of business like intention. The force of the jerk is often considerable, as the pellets are thrown several inches from the mouth of the nest.

Less than twenty-four hours is occupied in the construction of the nest. One begun at twelve thirty P. M. was three inches deep at four, the same day. The following morning, between six-thirty and seven, the bee was observed entering, her hind legs and body heavily laden with flocculent masses of pollen. She remained within for one minute, presumably packing the pollen, came out and was gone for five to six minutes, returning again laden with pollen. Sometimes the load is so superabundant that fragments of it will be dropped on the ground near the entrance. If the weather were cloudy, the time was lengthened, more than ten minutes being required for collection of the pollen. After a final trip she remained within for a longer time, i. e., twenty minutes, possibly occupied in laying an egg. The nest is completed by gnawing away the raised rim of earth about the opening. Usually the surrounding pellets are also drawn in by the first pair of legs, the earth thus filling and closing the entrance. A nearly circular depression, however, marks the site, for the earth is not filled in level with the soil surface.

On digging the earth away from the nest cavity, a considerable mass of fermenting pollen of sour smell was found and on it a single, slightly curved egg, six mm. in length. The pollen is collected,

apparently only in the early morning hours, for no bees were seen bearing pollen in the middle or latter part of the day. Many plants were blooming in the vicinity, wild Compositæ and Leguminosæ, also cultivated sweet peas and morning glories, but none of them were visited by the bees. Since the heavy, sticky masses brought back by them resembled in appearance the pollen of *Hibiscus moschatus*, which grew abundantly in the swamps not far away, it was suspected that this plant might be the source of supply. A comparison under the microscope of *Hibiscus* pollen with some taken from a nest proved this to be the case.

Although the behavior of the bees corresponds in general to the foregoing description, some variation was observed. As is often the case with solitary wasps, nests may be begun and abandoned before completion. The wall of earth around the entrance is more carefully built in some nests than in others, and the distance to which the pellets are thrown also varies. Individual differences in the ease with which the nest was recognized were also noticed. Some fly with astonishing directness and rapidity to the opening, while others alight at the wrong spot and appear confused. Bees sometimes enter nests not their own, and, on discovering the mistake, back hurriedly out. Before emerging it is usual for the insect to stop a moment at the opening, moving the head from side to side as if reconnoitring. Slight movement or noise in the neighborhood will cause her to jerk back into the nest, but after a short interval, she slowly reappears, again reconnoitres and flies off. Individuals differ in this respect also; some appear more timid than others.

On Nov. 29, I again visited the place, in order to determine if possible how the bees passed the winter. No trace remaining of the depressions marking the site of the nests, I was obliged to dig at random. The quest proved not entirely fruitless and three cocoons were obtained containing larvæ. The cocoon is made of densely woven silk entangling many left over pollen grains and lined with a brownish varnish-like substance, well adapted to keep out the dampness. The largest of the three measures a little over two centimetres (about twenty three mm. by thirteen, the smallest about thirteen mm. in each dimension and the third about sixteen mm. by thirteen mm. This last was broken in removing it from the soil. It contained a small larva not quite a centi-

metre long. The remaining two cocoons were buried in soil contained in a tin box and when next examined, Dec. 28, the larva within the larger cocoon was found dead. The small head, bearing distinct black jaws was bent under the body as was also the posterior end. The body nearly equalled in length the longer diameter of the cocoon. As the male of the closely related species, *E. bombiformis* is smaller than the female, the most probable explanation of the difference in the size of the cocoons is that the larger ones contain females, the smaller ones males.

Since writing the foregoing, I have discovered in the Journal of the N. Y. Entomological Society for Dec. 1911, an article entitled "Contributions toward the Life History of *Emphor bombiformis*," by John A. Grossbeck, a record of observations made at Arlington, N. J. The account does not in all respects correspond to the observations made on *E. fuscojubatus*, and as it would be interesting to know whether the two behave differently because they are different species or because of difference in the environment, I think, it worth while to call attention to the nature of the discrepancies.

Grossbeck describes the bee as beginning the nest by digging with the fore legs in a thin layer of sod, brushing the fragments away with the hind legs and turning around constantly. When the hole is one-half an inch deep, soil is reached and a different method of working begun. The soil is now moistened with saliva, small pieces bitten off with the mandibles, where, with the assistance of the abdomen, it is placed at the entrance. No doubt the difference in the manner of beginning to dig is due to the difference in the character of the soil, for in the location chosen by *E. fuscojubatus* there was practically no sod and the bee commenced to work at once on a sandy surface.

The bees at Cape May Point seemed but little disturbed by our presence at any time, except that when reconnoitring at the mouth of the nest, a sudden movement or noise would cause a hasty retreat. We were able to sit quietly very close to the opening without interfering with their comings and goings. On the other hand, the bees at Arlington showed great commotion, flew wildly about, buzzed loudly and were so reluctant to enter their burrows that a group of a little more than twelve were increased to about thirty. Quiet ensued in about five minutes and later in the day

they were not disturbed by human presence. The observer remained, however, about two feet away from the nest openings.

More than once, also, Grossbeck noticed bees showing animosity toward each other. On one occasion when a pollen-laden bee returned to find its burrow already occupied by another, also pollen-bearing, there followed a really dramatic episode. Both came out hurriedly, buzzed around, clenched, rolled on the ground, separated and were then lost to sight. Presently one returned, presumably the rightful owner, and rapidly removed three loads of pollen, two of which were dropped not far from the entrance and the third was carried farther away. The colony of *E. fuscojubatus*, on the contrary, so far as we could tell lived together, mutually harmonious, yet independent. It is well known that some strains of *Apis mellifica* show much greater excitability and pugnacity than others and it is quite possible that, of these two closely related species, one is more readily moved to fear or wrath than the other.

Exactly at what hour *E. bombiformis* was seen carrying pollen is not stated, but it is to be supposed from the following that it was in the afternoon. Referring to the greater ease with which pollen-laden bees find the entrance, Grossbeck remarks "There was no uncertainty displayed as in the morning hours." This is strikingly different from the habit of *E. fuscojubatus*, which was to collect pollen only in the early morning.

It seems likely that the reason why pollen-laden bees fly so directly to their burrows is that, in the course of frequent trips to and fro during the making of the nest, they have gained a more thorough familiarity with the surroundings. As far as I remember, this directness of flight was not confined to bees bearing pollen.

On Aug. 22, Grossbeck saw bees on a roadside puddle, but was not sure whether they actually lapped up the water or not. A rather strong wind was blowing at the time, by which the insects were constantly swept across the puddle. "They seemed to fly back to the windward side when blown across, for mere sport." I think there can be no doubt that the bees actually do take up the water, because of the regularity of their visits to the pond or puddle, the time that they spend there and the quantity of fluid coming from the mouth, used to moisten the earth and form pellets.¹

¹ F. Knab reports seeing *E. bombiformis* at the edge of a marsh on the outskirts of Washington, alighting on the surface of the water. They remained usually about 10 sec., the proboscis in contact with the water.—Proc. Wash. Ent. Soc., 1911, p. 170.

Perhaps the most striking difference in the habits of the two species is indicated by the fact that the eggs and larvæ obtained by Grossbeck were dug from open burrows and nothing was seen like a covered burrow. *Emphor fuscojubatus* very plainly makes use of the turret earth and even the ejected pellets for covering the nest not long after oviposition, leaving, however, a nearly circular depression somewhat like the impression of a finger tip in the sand.

That no bees were seen at Arlington after Sep. 3 may very well have been due to unfavorable weather conditions. At Cape May Point some were still active during the first week of September, but how much longer I do not know.

The death rate of the larvæ must be high, for from twenty-one cocoons preserved by Grossbeck he reports as emerging only one male and six females. This took place between July 11 and July 20, although on July 21 no bees were seen in the vicinity of the nesting site. Probably the time of emerging from the cocoon is nearly the same for *E. fuscojubatus*, although I have as yet made no observations on this point.

ANTS COLLECTED IN GEORGIA BY DR. J. C. BRADLEY AND MR. W. T. DAVIS.

BY WILLIAM MORTON WHEELER.

The following list is compiled from a large collection of ants made in different parts of Georgia by Dr. J. C. Bradley and a smaller collection made by Mr. W. T. Davis in a more restricted area. I have indicated the names of these collectors by their initials for each locality.

FAMILY FORMICIDÆ.

Subfamily Ponerinæ.

1. *Stigmatomma pallipes* Haldem.—Clayton (J. C. B.); Black Rock Mt., Rabun Co. (W. T. D.).
2. *Ponera trigona* Mayr var. *opacior* Forel.—Gainesville and Billy's Island, Okefenokee Swamp (J. C. B.).
3. *Ponera opaciceps* Mayr.—St. Simon's Island (J. C. B.).
4. *Ponera coarctata* Latr. subsp. *pennsylvanica* Buckley.—Spring Creek, Burton, Thalman and Atlanta (J. C. B.).

5. *Odontomachus hæmatoda* L. subsp. *insularis* Guérin.—Bainbridge, Ducker, Spring Creek and Billy's Island, Okefenokee Swamp (J. C. B.).

Subfamily Dorylinæ.

6. *Eciton (Acamatus) opacithorax* Emery.—Darien (J. C. B.); Clayton (W. T. D.).

Subfamily Myrmicinaæ.

7. *Pseudomyrma brunnea* F. Smith.—Bainbridge, Cumberland, St. Simon's Island and Billy's Island, Okefenokee Swamp. (J. C. B.).
8. *Pseudomyrma pallida* F. Smith.—Spring Creek and Tybee Island (J. C. B.).
9. *Pseudomyrma flavidula* F. Smith.—Ogelthorpe and Billy's Island, Okefenokee Swamp (J. C. B.).
10. *Myrmecina graminicola* Latr. subsp. *americana* Emery.—Gainesville (J. C. B.).
11. *Myrmica scabrinodis* Nyl. var. *schencki* Emery.—Clayton (W. T. D.).

12. *Leptothorax bradleyi* sp. nov.

Worker. Length 2.6 mm.

Head rather large, subrectangular, a little longer than broad, with straight, parallel sides and feebly excised posterior border. Eyes rather small, at the middle of the sides of the head. Mandibles and clypeus moderately convex, the latter with straight, entire anterior border. Frontal area small and indistinct. Antennæ 11-jointed; scapes reaching half way between the eyes and the posterior corners of the head; funiculi with a 3-jointed club; first funicular joint as long as the three succeeding joints together; joints 2-6 much broader than long, joint 7 as long as broad; terminal joint longer than the two penultimate joints together. Thorax rather robust, narrower than the head, broader in front than behind, but as high behind as in front, with flattened dorsal and lateral surfaces and rather angular humeri, without any traces of a mesoepinotal constriction. Epinotal spines stout, as long as broad at their bases, laterally compressed, suddenly tapering at their tips, directed backward and slightly upward, further apart at their bases than long. Petiole from above about $1\frac{1}{2}$ times as long as broad, pyriform, with rounded sides; its node in profile with feebly concave anterior and decidedly convex posterior slopes, meeting with a distinct transverse ridge, the lower border in profile feebly concave and with a small, compressed anterior tooth. Postpetiole from above transversely elliptical, slightly broader than the petiole, slightly broader than long, in profile smaller than the petiole, as long as high, with evenly rounded, convex node. Gaster elongate elliptical, its sides rather straight, its anterior border excised in the middle. Legs stout, with incrassated femora.

Head, including the mandibles, thorax, petiole, postpetiole and antennæ opaque; gaster and legs shining. Mandibles finely longitudinally striated. Clypeus coarsely longitudinally rugose, on the sides reticulately rugose. Head above and on the sides finely and evenly longitudinally rugose, with the interrugal spaces reticulate-punctate. Thorax, petiole and postpetiole densely punctate, the thorax also reticulately and longitudinally rugose both on the dorsal and pleural surfaces.

Hairs yellowish, short and rather abundant, clavate and erect on the head, thorax and abdomen, appressed and pointed on the legs and scapes.

Color ferruginous red; antennæ, legs and gaster, except the posterior borders of the segments, somewhat paler; mandibular teeth black.

Described from a single specimen taken by Mr. J. C. Bradley on Billy's Island in the Okefenokee Swamp.

In the shape of the body and in coloration, this species is very similar to *L. schaumii* Roger, but differs in the much coarser, longitudinal rugosity of the head and thorax, much larger and differently shaped epinotal spines and in the shape of the petiolar node, the sides and posterior declivity of which are much more convex and rounded. From *L. fortinodis* Mayr., *bradleyi* differs in these same characters, except the shape of the petiole, and in the paler coloration.

13. *Leptothorax curvispinosus* Mayr.—Atlanta and Clayton (J. C. B.).
14. *Leptothorax (Dichothorax) pergandei* Emery.—Atlanta (J. C. B.).
15. *Pogonomyrmex badius* Latr.—Bower Station, Albany, Bainbridge, Spring Creek, Tybec Island, St. Simon's Island and Billy's Island, Okefenokee Swamp (J. C. B.).
16. *Aphænogaster lamellidens* Mayr.—Gainesville, Spring Creek and Thunderbolt (J. C. B.).
17. *Aphænogaster treatæ* Forel.—Tallulah Falls, Clayton and Black Rock Mt., 2000–3500 ft. (J. C. B.).
18. *Aphænogaster treatæ* Froel var. *ashmeadi* Emery.—Atlanta and St. Simon's Island.
19. *Aphænogaster fulva* Roger.—Black Rock Mt., Spring Creek and Gainesville (J. C. B.).
20. *Aphænogaster fulva* Roger subsp. *aquia* Buckley.—Summer-ville, Tallulah Falls, Clayton, Atlanta, Black Rock Mt., and Billy's Island, Okefenokee Swamp (J. C. B.).
21. *Aphænogaster tennesseensis* Mayr.—Clayton (J. C. B. and W. T. D.).

22. *Monomorium minimum* Buckley.—Cave Springs, Spring Creek, Atlanta, Thunderbolt and Billy's Island, Okefenokee Swamp (J. C. B.).
23. *Monomorium pharaonis* L.—Albany (J. C. B.).
24. *Crematogaster ashmeadi* Mayr.—Gainesville and Atlanta (J. C. B.).
25. *Crematogaster lineolata* Say.—Oglethorpe, and Billy's Island, Okefenokee Swamp, Atlanta (J. C. B.).
26. *Crematogaster lineolata* Say var. *lutescens* Emery.—Athens, St. Simon's Island, Tallula Falls, Gainesville, Fitzgerald and Billy's Island, Okefenokee Swamp (J. C. B.).
27. *Crematogaster lineolata* Say var. near *lutescens* Emery.—Tallulah Falls, Spring Creek, Black Rock Mt. and Gainesville (J. C. B.).
28. *Crematogaster lineolata* Say var. *subopaca* Emery.—Black Rock Mt. (J. C. B.).
29. *Crematogaster lineolata* Say subsp. *subpilosa* Pergande.—Clayton, 2000–3500 ft. (W. T. D.).
30. *Solenopsis geminata* Fabr.—St. Simon's Island, Spring Creek, Waycross and Billy's Island, Okefenokee Swamp (J. C. B.).
31. *Pheidole vinelandica* Forel.—Clayton and Gainesville (W. T. D.).
32. *Pheidole tysoni* Forel.—Tallulah Falls (J. C. B.); Clayton (W. T. D.).
33. *Pheidole metallescens* Emery.—Thunderbolt and St. Simon's Island (J. C. B.).
34. *Pheidole dentata* Mayr.—Cornelia (W. T. D.).
35. *Pheidole dentata* Mayr. var. *faisonica* Forel.—Tallulah Falls (J. C. B.).
36. *Pheidole dentata* Mayr. var.—St. Simon's Island, Tybee Island, Gainesville and Spring Creek (J. C. B.).
37. *Pheidole crassicornis* Emery.—Bainbridge (J. C. B.).
38. *Pheidole crassicornis* Emery var.—Black Rock Mt. (J. C. B.).
39. *Atta (Trachymyrmex) septentrionalis* MacCook.—Bainbridge and Spring Creek (J. C. B.).

Subfamily Dolichoderinae.

40. *Dolichoderus (Hypoclinea) mariae* Forel.—Toccoa and Clayton (J. C. B.).

41. *Dolichoderus (Hypoclinea) pustulatus* Mayr. var. *beutenmuelleri* Wheeler.—Cornelia (W. T. D.).
42. *Dorymyrmex pyramicus* Roger.—Atlanta, Ducker and Gainesville (J. C. B.).
43. *Dorymyrmex pyramicus* Roger var. *flavus* MacCook.—Spring Creek, Gainesville, Thunderbolt and Atlanta (J. C. B.).
44. *Iridomyrmex pruinosus* Roger.—Tybee Island, Savannah and Billy's Island, Okefenokee Swamp (J. C. B.).
45. *Iridomyrmex pruinosus* var. *analis* Ern. André.—Atlanta and Gainesville (J. C. B.).
46. *Tapinoma sessile* Say.—Waycross and Spring Creek (J. C. B.).

Subfamily Camponotinae.

47. *Prenolepis imparis* Lay.—Clayton, 2000–3700 ft. (W. T. D.).
48. *Prenolepis imparis* Lay var. *testacea* Emery.—Gainesville. Tybee Island, Marietta and Atlanta (J. C. B.).
49. *Prenolepis (Nylanderia) longicornis* Latr. Bainbridge; "a very annoying pest and excessively abundant" (J. C. B.).
50. *Prenolepis (Nylanderia) arenivaga* Wheeler.—Spring Creek (J. C. B.).
51. *Prenolepis (Nylanderia) vividula* Nyl.—Gainesville and Billy's Island, Okefenokee Swamp (J. C. B.).
52. *Lasius niger* L. var. *americanus* Emery.—Gainesville and Tybee Island (J. C. B.).
53. *Lasius (Acanthomyops) murphyi* Forel.—Clayton (J. C. B.).
54. *Lasius (Acanthomyops) interjectus* Mayr.—Gainesville (J. C. B.).
55. *Formica truncicola* Nyl. subsp. *integra* Nyl.—Atlanta and Stone Mt. (J. C. B.).
56. *Formica truncicola* Nyl. subsp. *obscuriventris* Mayr.—Clayton (W. T. D.).
57. *Formica difficilis* Emery var.—Clayton (W. T. D.).
58. *Formica fusca* L. var. *subsericea* Say.—Black Rock Mt. and Spring Creek (J. C. B.).
59. *Formica (Neoformica) pallidefulva* Latr.—Tallulah Falls, Marietta, Ducker, Clayton, Clarkesville, Atlanta and Black Rock Mt. (J. C. B.).
60. *Formica (Neoformica) pallidefulva* Latr. subsp. *schaufussi* Mayr.—Black Rock Mt. (J. C. B.).

61. *Formica* (*Neofornica*) *pallidefulva* Latr. subsp. *schaufussi* Mayr. var. *dolosa* Wheeler—Clayton (W. T. D.).
62. *Formica* (*Neofornica*) *pallidefulva* Latr. subsp. *nitidiventris* Emery var. *fusca* Emery—Thunderbolt and Savannah (J. C. B.).
63. *Camponotus socius* Roger.—Spring Creek, Ducker and Darien (J. C. B.).
64. *Camponotus abdominalis* Roger subsp. *floridanus* Buckley.—Bainbridge, Brunswick, St. Simon's Island, Tybee Island, Spring Creek, Honey Island and Billy's Island, Okefenokee Swamp (J. C. B.); St. Mary's (O. Bangs).
65. *Camponotus castaneus* Latr.—Tallulah Falls and Waycross (J. C. B.).
66. *Camponotus castaneus* Latr. subsp. *americanus* Mayr.—Summerville, Black Rock Mt. and Billy's Island, Okefenokee Swamp (J. C. B.).
67. *Camponotus herculeanus* L. subsp. *pennsylvanicus* DeGeer.—Clayton (W. T. D.); Bainbridge, Summerville, Vienna, Cave Springs, Spring Creek and Blackspear (J. C. B.).
68. *Camponotus herculeanus* L. subsp. *pennsylvanicus* DeGeer var.—Gainesville (J. C. B.).
69. *Camponotus fallax* Nyl. var. *nearcticus* Emery.—Burton, Clayton and Billy's Island, Okefenokee Swamp (J. C. B.).
70. *Camponotus fallax* Nyl. subsp. *discolor* Emery.—"Georgia" (J. C. B.).
71. *Camponotus fallax* Nyl. var. *near. decipiens* Emery.—Athens (J. C. B.); Clayton, 2000–3700 ft. (W. T. D.).
72. *Camponotus* (*Colobopsis*) *impressus* Roger.—Spring Creek and St. Simon's Island (J. C. B.).

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PSYCHE

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ON A COLLECTION OF THYSANOPTERA FROM PANAMA.

BY J. DOUGLAS HOOD,

United States Biological Survey.

A small collection of *Thysanoptera* made in the Canal Zone, Panama, by Mr. James Zetek of the Isthmian Canal Commission during the year 1912, furnishes the basis for the present article. There appear to be no published records of any thrips occurring in that region. This fact, together with the finding of two species new to science and the knowledge gained of the distribution of the several other species, has made the collection of more than passing interest. Under each species mentioned is given a summary of its known geographical distribution, together with such additional locality records as are furnished by the specimens in all collections to which I have had access.

Franklinothrips vespiformis Crawford.

Distribution: Managua, Nicaragua (Crawford); Florida (Back); Brownsville, Texas; Miraflores, Canal Zone.

An easily recognized species, very distinct from *Eolothrips* in which it was originally described. Known previously only from Nicaragua and Florida, but quite common in sweepings from grass and weeds at Brownsville, Texas, and in the Canal Zone.

Frankliniella insularis Franklin.

Distribution: Barbados (Franklin); Guadalajara, Mexico (Crawford); Brownsville, Texas (Russell); Monterey, Mexico; Miraflores, Canal Zone, Panama.

Probably the most abundant thrips in Central America. The specimens from Miraflores were taken in "sweepings along a stream and in small clearings."

Frankliniella minuta Moulton.

Distribution: California (Moulton, Crawford); Brownsville, Texas; Topo Chico (near Monterey), Mexico; Ancon, Canal Zone, Panama.

A common flower-frequenting species of the southwest, known previously only from California.

Heliothrips hæmorrhoidalis Bouché.

Distribution: Europe; Asia; Australia; North America; Hawaiian Islands; St. Vincent and Barbados Islands (Franklin); Ancon, Canal Zone, Panama.

A cosmopolitan greenhouse pest, indigenous to tropical and subtropical America. One specimen was taken at Ancon, in sweepings.

Liothrips zeteki sp. nov.

(Figs. 1, 2.)

Female: Length about 2.2 mm. Color dark blackish brown or black; thorax, tarsi, and tip of tube slightly paler; third antennal segment abruptly pale yellow.

Head about 1.5 times as long as wide, broadest across or just behind eyes; cheeks nearly straight, subparallel, slightly converging posteriorly, at extreme base with distinct collar-like widening; vertex elevated, produced, anterior ocellus distinctly overhanging; dorsal and lateral surfaces slightly roughened with transverse lines, set with several short spines; postocular bristles truncate, about as long as eyes. Eyes one third as long as head. Posterior ocelli opposite anterior third of eyes. Antennæ 1.6 times as long as head, moderately slender; segments 1 and 2 nearly concolorous with body, 2 slightly paler in apical half; 3 pale yellow; 4-8 nearly black, 4 paler in outer apical half; segments 3-6 clavate, pedicellate; 7 oblong, pedicellate; 8 subconical; sense cones slender, colorless, formula: 3, 0-1; 4, 1-2⁺; 5, 1-1⁺; 6, 1-1; 7 with one on dorsum near apex.¹ Mouth cone subacute, nearly attaining base of prosternum.

Prothorax about .6 as long as head, and (inclusive of coxæ) about 2.4 times as wide as long; all bristles present, long, stout, truncate, nearly black in color, the two pairs near the posterior angles longest; coxal bristle truncate, about equal in length to anterior marginals. Pterothorax wider than prothorax and a little wider than long; sides straight, slightly converging posteriorly. Wings long, closely fringed, not narrowed at middle; fore wings brown in basal fifth, margined with a slight shading of brown, and with a median brown bar extending the entire length of the wing; subapical fringe on posterior margin double for 14-16 hairs; hind wings brown at extreme base and with a submedian brown bar which becomes paler toward apex of wing. Legs moderately stout; fore tarsi unarmed.

¹The explanation of the formula used in the description of the antennal sense cones has been given by the writer in Ann. Ent. Soc. Amer., vol. I, no. 4, p. 285; and in Ent. News, vol. XX, no. I, p. 29, footnote.

Abdomen large, wider than pterothorax, tapering roundly from segment 6 to base of tube. Tube about .8 as long as head, twice as wide at base as at apex, tapering evenly. Abdominal bristles moderately long, black, nearly all blunt; terminal bristles slightly shorter than tube.

Measurements of holotype: Length 2.2 mm.; head, length .336 mm., width .228 mm.; prothorax, length .185 mm., width (inclusive of coxæ) .451 mm.; pterothorax, width .504 mm.; abdomen, width .600 mm.; tube, length .276 mm., width at base .114 mm., at apex .054 mm. Antennal segments: 1, 48 μ ; 2, 60 μ ; 3, 99 μ ; 4, 84 μ ; 5, 81 μ ; 6, 72 μ ; 7, 63 μ ; 8, 36 μ ; total length of antenna, .54 mm.; width at segment 4, .046 mm.

Male: Smaller and slenderer than female; otherwise nearly identical.

Measurements of allotype: Length 1.92 mm.; head, length .288 mm., width .204 mm.; prothorax, length .138 mm., width (inclusive of coxæ) .388 mm.; pterothorax, width .408 mm.; abdomen, width .408 mm.; tube, length .252 mm., width at base .087 mm., at apex .045 mm. Antennal segments: 1, 45 μ ; 2, 54 μ ; 3, 87 μ ; 4, 78 μ ; 5, 73 μ ; 6, 67 μ ; 7, 58 μ ; 8, 31 μ ; total length of antenna, .49 mm.; width at segment 4, .039 mm.

Described from two females and one male taken by Mr. James Zetek in January, 1912, in sweepings, Miraflores, Canal Zone, Panama.

The antennal coloration and general structure allies this species closely to *varicornis* Hood, described from Mexico. It differs conspicuously, however, in the much longer head, shorter antennæ, and the truncate postocular and prothoracic bristles. I take pleasure in naming it for its collector, an enthusiastic, energetic entomologist and a friend of many years.

Leptothrips aspersus Hinds.

Distribution: *United States:* Amherst, Mass., (Hinds); Orlando, Fla. (Back); Southern California (Crawford); Highspire, Pa.; Cabin John and Plummer's Island, Md. (near Washington, D. C.); Washington, D. C.; Bloomington, Ind.; Boskydell, (near Carbondale), Carbondale, Cobden, Dubois, Duquoin, Grand Tower, Havan, Hillery (near Danville), Mankanda, Metropolis, Muncie, Murphosboro, Odlin, Parker, Pulaski, St. Joseph, Tennessee, Urbana, and White Heath, all in Illinois; Wittenburg, Mo.; Brownsville, Texas. *Mexico:* Gualalajara (Crawford), Matamoros, Monterey, and Topo Chico (near Monterey). *West Indies:* Barbados (Franklin). *Panama:* Miraflores, Canal Zone.

Throughout its range this species varies but little except in size, though the Panama specimens differ almost constantly in

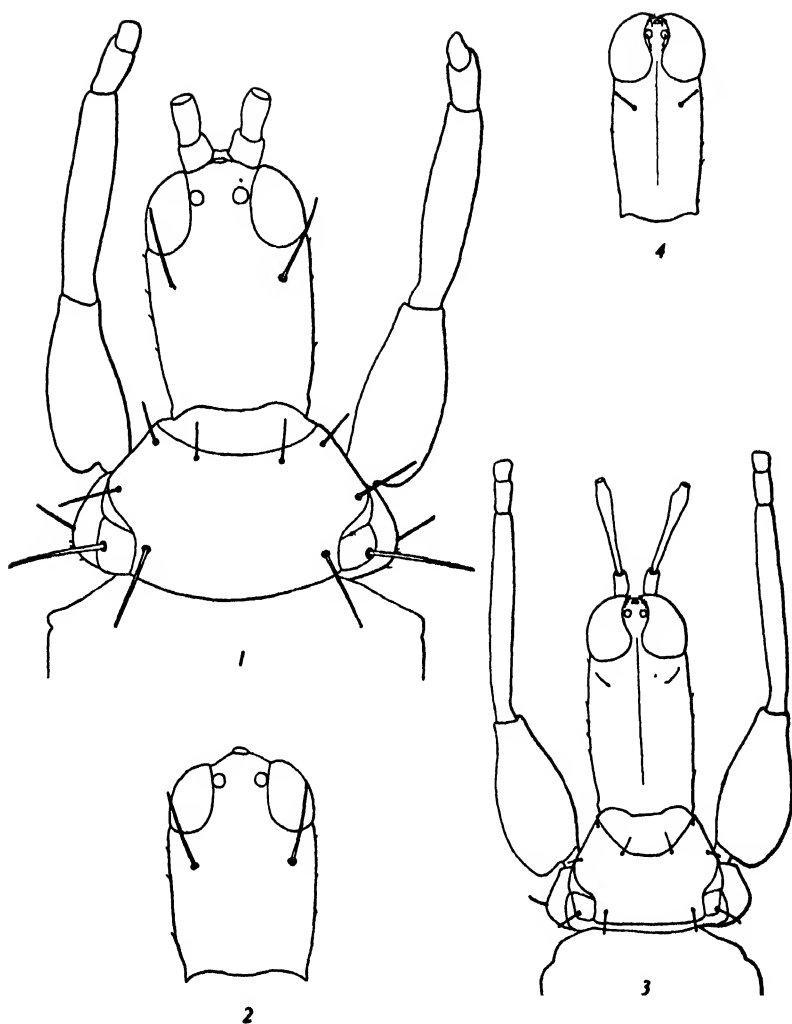


Fig. 1. *Liothrips zeteki* sp. nov., head and prothorax, female.

Fig. 2. *Liothrips zeteki*, head of male.

Fig. 3. *Polyommatothrips vigilans* sp. nov., head and prothorax, female.

Fig. 4. *Polyommatothrips vigilans*, head of male.

having a dark median vitta in the basal half of the fore wings, Thirteen specimens were taken at Miraflores in January, in "sweepings along a stream and in small clearings."

Polyommatothrips vigilans sp. nov.

(Figs. 3, 4.)

Female: Length about 3.0 mm. Color blackish brown, with abundant maroon hypodermal pigmentation; abdominal segments 3-8 at base with a pair of small latero-dorsal white blotches (as in *Acanthothrips nodicornis* Reuter); fore tarsi, ends of fore tibiae, and apex of fore femora yellow; antennae largely yellow; tube paler in apical half.

Head twice as long as wide, broadest midway between eyes and base, compressed and subcarinate above; dorsal and lateral surfaces finely subreticulate, sparsely and briefly spinose, without prominent tubercles; cheeks gently arcuate, with short collar-like thickening at base; postocular bristles short, only one third as long as eyes, slightly dilated at tip. Eyes very finely and closely faceted, somewhat protruding, less than one third as long as head, extending inward nearly to the median line and almost completely surrounding the ocelli. Ocelli anterior, equidistant, subapproximate. Antennae 1.6 times as long as head, very slender; segments 3-6 clavate, abruptly narrowed apically, urn- or vase-shaped (as in *Acanthothrips*); 7 fusiform-truncate, closely united to 8, which is conical; segments 1 and 2 pale brownish yellow; 3 yellow, clouded apically, nearly black at apical constriction; 4 yellow, nearly black at extreme base and apex, clouded in apical third; 5 and 6 yellow, black at extreme base, washed with blackish brown in apical half and two thirds, respectively; 7 and 8 blackish brown; sense cones long, slender, broad at base, those on segment 3 less than one third the length of segment; formula: 3, 1-2; 4, 1-2⁺; 5, 1-1; 6, 1-1; 7 with one on dorsum near apex. Mouth cone and palpi very long, acute, nearly attaining metasternum.

Prothorax deeply emarginate in front, its median dorsal length about two thirds the lateral length, the latter half that of head and half the width across fore coxae; all usual bristles present, short, slightly dilated at tip. Pterothorax slightly wider than long, broader than prothorax; sides nearly straight, slightly converging posteriorly. Wings long, closely fringed, not narrowed at middle; fore wings about one and one half times as wide at basal fifth as at middle; scale and the region of the three subbasal spines dark brown; a dark bar occupies the anal half of the second fourth of the fore wings, darkest toward the median line, along which it is continued nearly to apex of wing; costal half of second fourth of fore wings darkened with brown; subapical fringe on posterior margin of fore wings double for about 32 hairs; hind wings brown at base and with prominent dark median vitta reaching nearly to apex. Legs long and slender; fore femora swollen; fore tarsi unarmed.

Abdomen slender, seemingly narrower than pterothorax. Tube less than half as long as head and more than half as wide at apex as at base, opaque black in basal half, brown in apical half. Marginal abdominal bristles (excepting those on segment 9, which are pointed and fully twice as long as tube) moderately short, blunt; terminal bristles lacking in the type.

Measurements of holotype: Length 3.02 mm.; head, length .576 mm., width .293 mm.; prothorax, length from anterior angle to base .288 mm., width (inclusive of coxæ) .564 mm.; pterothorax, width .600 mm.; abdomen, width .576 mm.; tube, length .252 mm., width at base .093 mm., at apex .054 mm. Antennal segments: 1, 72 μ ; 2, 84 μ ; 3, 231 μ ; 4, 171 μ ; 5, 159 μ ; 6, 96 μ ; 7, 81 μ ; 8, 42 μ ; total length of antenna, .93 mm.; width at segment 3, .048 mm.

Male: Smaller and slenderer than female (length about 2.8 mm.). Eyes larger, very prominent. Antennæ longer and more slender. Terminal abdominal bristles one and one half times as long as tube. Otherwise nearly as in female.

Measurements: Length 2.83 mm.; head, length .540 mm., width across eyes .270 mm.; prothorax, length from anterior angle to base .240 mm., width (inclusive of coxæ) .420 mm.; pterothorax, width .468 mm.; abdomen, width .420 mm.; tube, length .252 mm., width at base .093 mm., at apex .054 mm. Antennal segments: 1, 72 μ ; 2, 84 μ ; 3, 231 μ ; 4, 174 μ ; 5, 165 μ ; 6, 117 μ ; 7, 87 μ ; 8, 48 μ ; total length of antenna, .98 mm.; width at segment 3, .045 mm.

Described from one individual of each sex, taken in sweepings near Paraiso, Canal Zone, Panama, by Mr. James Zetek.

This anomalous insect differs from its congener *silvestrii*, described from Argentina, in several important particulars, the most noticeable being the absence of spiniferous genal tubercles, the deeply emarginate pronotum, the abdominal coloration, and the size. Minor additional differences may also be noticed in the form of the head, the length of the eyes, the comparative lengths of the third, fourth, and fifth antennal segments, and the lengths of the antennal sense cones and the prothoracic bristles. The compressed dorsum of the head is normal and especially interesting, occurring to the best of my knowledge in no other species. Another remarkable point of structure, and which was not mentioned in the original generic description, lies in the mode of insertion of the antennæ, these being attached to the ventral surface of the head and in life apparently directed diagonally downward, nearly at right angles to the top of the head. The emargination of the pronotum allows the head to be tipped back at an angle of about forty-five degrees.

THE STANFORD EXPEDITION TO BRAZIL, 1911.

J. C. BRANNER, *Director*.THE PHYTOPHAGA (EXCEPT CASSIDÆ AND HISPIDÆ)
OF THE STANFORD EXPEDITION TO BRAZIL.

BY FRED C. BOWDITCH.

Through the kindness of Mr. Wm. M. Mann the Phytophaga as above, taken by the Stanford Expedition, have been placed in my hands for identification, the localities are stated in detail on page 72 in Mr. Wolcott's paper on the Cleridæ. The collection is unfortunately small numerically in comparison with the number of species represented, but contains some interesting forms. The types and certain other specimens are in my collection. The numbers (in parenthesis) after some of the species are those affixed by Prof. R. Thaxter in his researches for Laboulbeniaceæ.

In addition to the species given below there are a few undetermined forms.

<i>Lema sagittifera</i> Lac.	Natal	1	
<i>gracilis</i> Lac. (2212)	Pará, Independencia	2 (2212)	Ceará-Mirim
<i>orbignyi</i> Lac.	Maranguape Mts.	3	
<i>teniata</i> Bates	"	1	
<i>historionica</i> Lac.	Independencia	2	
<i>Megascelis lacertina</i> Lac.	"	5	
near <i>virgo</i> Lac.	Independencia	1	
near <i>viripidallens</i> Clk.	Rio Madeira	1	
<i>Pseudochlamys megalostomoides</i> Lac.	Natal	1 ♂	
<i>Chlamys hispidula</i> Klug.	Porto Velho	1	
<i>Anomæa humerigera</i> Lac.	Rio Madeira	1	
<i>Pachybrachys contortus</i> Baly	{ Ceará	1	
sp.	{ Maranguape Mts.	1	
sp.	Natal	12	
sp.	Independencia	3	
sp.	"	1	
sp.	"	1	
<i>Scolochrus fallax</i> Moritz	"	2	
<i>Monachus gemellus</i> Suff.	{ "	8	
near <i>contractus</i> Boh.	{ Ceará	2	
near <i>contractus</i> Boh.	Ceará	1	
<i>Dachrys pusillus</i> Lac. ?	Independencia	1	
	"	1	

<i>Megalostomis luctuosa</i> Lac.	Porto Velho	1
<i>Proctophana tomentosa</i> Lac.	Ceará	1
<i>Lamprosphaerus near hebe</i> Baly	Independencia	2
<i>janthinus</i> Lef.	"	1
sp.	Rio Madeira	2
<i>Habrophora</i> sp. ?	"	1
<i>Colaspoides fulgurans</i> Lef.	Porto Velho	1
<i>Colaspis æruginosa</i> Lef.	Rio Madeira	11
14-costata Lef.	Natal	1
strigosa Lef.	Rio Madeira	1
suturalis Lef.	Ceará	1
inconspicua Jac.	Independencia, Ceará, Natal	8
cribricollis Lef. ?	"	8
<i>Podozenus iripennis</i> Bow. nov. sp.	Rio Madeira	1
limbatus Lef.	Maranguape Mts.	1
<i>Metaronycha pulchella</i> Baly	Rio Madeira	1
<i>Agbalus strigatus</i> Lef.	"	2
<i>Corysthea cribrata</i> Lef.	Independencia-Ceará	2
<i>Nodostoma fraterna</i> Lef.	" -Manaos	2
<i>Chalcophana hilaris</i> Germ.	Manaos	2
<i>Nodonota</i> sp. ?	Itacoatiara	1
<i>Paria boggiani</i> Jac. ?	Ceará	1
<i>Typophorus versutus</i> Lef.	Independencia-Ceará. Baturité Mts.	
	Maranguape Mts.	
annulatus Lef.	Independencia	1
<i>Myochrous tibialis</i> Jac.	Baturité Mts.	2
Bohemanni Lef.	Ceará	2
<i>Biorus femoralis</i> Lef.	Rio Madeira	1
<i>Eumolpus surinamensis</i> Fab.	"	-Para
<i>Doryphora Fabricii</i> Guér.	"	1
12-guttata Fabr.	Porto Velho	2
<i>Cælomera cayanensis</i> Fabr.	Rio Madeira	2
<i>Dircema septum</i> Erich.	"	-Manaos-Porto Velho
nigripenne Fabr.	Manaos	3
<i>Galerucella</i> sp.	Manaos	5
<i>Monocenta nigricornis</i> Clk.	"	2 (2221)
<i>Cerotana congener</i> Baly	Rio Madeira	-Porto Velho
excavata Baly	"	2
<i>xanthopus</i> Perty	"	1
sp. ?	"	1 ♀
arcuata Oliv.	Independencia	1
<i>Neobrotica 6-plagiata</i> Jac.	"	4
brasiliensis Bow. sp. nov.	Rio Madeira	1
<i>Diabrotica tarsata</i> Gahan	Rio Madeira	1
atromaculata Baly	"	2

<i>kirbyi</i> Baly	Independencia-Ceará	3
<i>significata</i> Gahan	"	(many)
<i>speciosa</i> Germ.	"	Baturité Mts.
<i>rufolimbata</i> Baly	"	2
<i>confraterna</i> Baly	Rio Madeira	1
<i>sedata</i> Baly ?	Independencia	2
<i>proximans</i> Baly	Manaos	1
<i>bivittula</i> Kirsch	Independencia-Para	4
<i>perplexa</i> Baly	"	-Baturité Mts. 2
<i>zelota</i> Gahan	Pará	1
<i>Pascæi</i> Baly	Ceará	1
<i>Luperus</i> near <i>subglabrata</i> Jac.	Rio Madeira	1
<i>Luperodes</i> sp.	{ Porto Velho (2220)	2
	{ Rio Madeira	1
<i>Hermæophaga</i> near <i>parvula</i> Jac.	Rio Madeira	-Independencia 2
near <i>teapensis</i> Jac.	Natal	6
<i>Systema</i> near <i>margenalis</i> Ill.	Independencia	1
<i>Notozona balyi</i> Jac.	Rio Madeira	1
<i>Trichaltica nigripennis</i> Bow. n. sp.	Ceará	5
<i>Disonycha glabrata</i> Fab.	Rio Madeira-Porto Velho	9
<i>amazonica</i> Jac.	"	1
<i>Sparnus</i> sp.	Rio Madeira	1
<i>Lactrica citrina</i> Har.	Independencia	1
near <i>femorata</i> Jac.	Porto Velho	2 (2239)
<i>sellata</i> Baly ?	Rio Madeira	1
<i>weisei</i> Jac.		1
sp.	Porto Velho	8
sp.	" "	4 (2219)
sp.	" "	1
<i>Homophyla adusta</i> Har.	Rio Madeira	1
<i>nigrita</i> Duv.	Independencia	3
<i>variabilis</i> Jac. ?	Rio Madeira	2
sp.	Ceará	1
<i>Homophyta recticollis</i> Baly	Rio Madeira	2
<i>abbreviata</i> Ol.	"	1
<i>bitæniata</i> Jac.	Manaos	6
<i>æquinotialis</i> Linn.	Independencia, Porto Velho, Para	4 (2213 Para)
<i>6-notata</i> Har.	Manaos	1
<i>annularis</i> Ill.	Rio Madeira	1
<i>Monoplatus</i> ?	Baturité Mts.	15
<i>Asphæra elegantissima</i> Schf.	Rio Madeira	2 (2218)
<i>abbreviata</i> Fabr.	"	1 (2217)
<i>4-maculata</i> Clark (var.?)	"	1
<i>siebersii</i> Ill.	Pará	2 (2234)
<i>fulcrata</i> Erich.	Independencia	1

<i>(Edionychis amazona</i> Bow. (<i>inconspicua</i> Jac.)	Rio Madeira	1
<i>bakeri</i> Bow. nov. sp.	Manaos	1
<i>bifasciata</i> Baly	Rio Madeira	3
<i>branneri</i> Bow. sp. nov.	"	1
<i>12-notata</i> Jac.	"	1
<i>ingrata</i> Jac.	Independencia	1
<i>interrupto-vittata</i>	Independencia	1
<i>manni</i> Bow. nov. sp.	Rio Madeira	1
<i>rufina</i> Ill.	Pará	1
<i>scissa</i> Germ. var.	{ Independencia	1
	{ Maranguape Mts.	1
<i>turpis</i> Jac.	Porto Velho	1 (2240)
<i>zebrata</i> Ill.	Independencia	1
<i>suffusa</i> Bow. sp. nov.	Rio Madeira	1
<i>dipus</i> Ill.	Pará	3

Podoxenus iripennis sp. nov.

Yellow, fulvous; mandibles, eyes, tarsi, upper half of 5 joint and joints 6, 7, and 9-10-11 of antennæ black, thorax margined, strongly angulate at middle, elytra suffused with cyaneous, except at posterior third.

Type 1 ♀ Rio Madeira length 6½ mm.

Head shiny impunctate, except between the eyes where a deep transverse fovea shows a few punctures, labrum large almost square, epistome broadly emarginate, vertex convex, thorax about half wider than long, strongly margined on the sides, which are regularly and sharply angulate at the middle, anterior angle sharp and prominent, surface shiny, coarsely and irregularly punctate, more crowded and semi confluent at the sides, elytra with a moderate subbasal depression, the surface thickly, rather coarsely punctured on the disk and behind and having a decided tendency to a geminate arrangement, the rows as usual becoming single towards the apex which is strongly costate, the costæ being continued as obsolete smooth lines for some distance forward, the cyaneous coloring avoids the sutural and lateral edges as well as the apex and shows only as a faint coppery reflection, body beneath entirely pale, except for the dark tarsi and the extreme tips of middle and posterior tibiæ.

The coloring of the elytra, the evenly angulate thorax and the sharply colored antennæ will help to separate this form.

Neobrotica brasiliensis sp. nov.

Head and thorax reddish yellow with a touch of green (thorax perhaps in living specimens green) antennæ pallid, elytra pallid yellowish green, with a basal band broken into 4 spots, a wide median band dilated externally and a thick semi lunate ante apical spot brownish black, feet yellow, tibiæ and tarsi brown, body below yellow with pectus brown.

1 ♀ Porto Velho

length 5½ mm.

Antennæ yellow, apex and middle fuscous joints 3 and 4 equal, thorax with a deep, transverse lunate depression not attaining the margins, scutellum dark brown, elytra semi shining, thickly punctate, the punctures arranged pretty regularly, in very close rows, the four basal spots are arranged two on either side of the suture and not touching it and two humeral, the middle band shows a tendency to run up and down the suture to join the anterior and posterior spots.

Superficially resembles my specimens of *denticornis* Jac (though not the figure in Biologia).

Trichaltica nigripennis sp. nov.

Elongate, very faint bronzy black, thorax reddish yellow, feet variable from black to more or less yellowish, elytra feebly costulate with fine punctures geminate at the sides and subgeminate on the disk and single rowed behind.

Type Ceará

length $3\frac{1}{2}$ mm.

The mouth and antennæ in some examples are slightly fuscous, the punctuation of the thorax is coarse, even and quite thick and the sides anteriorly show a slight sinuation, the pubescence of the elytra is uniform grayish arranged in lines, the bronzy color shown only faintly in a strong light.

Larger than most of the described forms (except *thammi* Baly) and very like an undescribed form from Argentine in my collection.

Edionychis bakeri sp. nov.

Testaceous, head very dark piceous, base of antennæ and apex of tibiae and tarsi piceous, body beneath black, each elytra with two short, straight black lines at the base, one humeral sublateral, the other almost median, also two small ante apical black spots placed obliquely, the outermost faint.

Type, Manaus, Brazil (1)

length 6 mm

About the form and size of *palpalis* Jac. not much dilated and rather flattened and elongate. Head smoother with only a few punctures near the eye, frontal foveæ deep, eyes comparatively close, the whole space between occupied by the foveæ, frontal carina prominent between the antennæ, which are about half the length of the body, scape very dark piceous, the next two or three joints shading off to testaceous, fourth joint slightly longer than the third, mouth parts almost light testaceous, thorax smooth shining, sides broadly depressed, anterior angles scarcely notched at the side, elytra smooth polished very minutely punctulate, the basal black marks are very narrow parallel sided black lines, the outer placed on the outside edge of the humerus and parallel to the margin and extending to the median third, the inner line is almost median, parallel to the suture and the shorter of the two, the rear marks are at the beginning of the convexity, in line with the front marks, the inner a black dot, the outer a stain, apical third of the elytra sparingly ciliate. Many of the genus seem to show cilia on the elytra to a greater or less extent though it is rarely mentioned. My specimens of *palpalis* Jac. show it.

***Cedionychis manni* sp. nov.**

Testaceous, head and body beneath black, each elytron with two short, pointed, basal, black marks, the outer covering the humerus, the inner edge of the other touching the scutel, and two small sub-apical, obliquely placed black dots.

Type, Rio Madeira, Brazil 1 length $7\frac{1}{2}$ mm.

Again like *palpalis* Jac. and closely allied to *Bakeri* Bow. Head black with a very deep frontal foveæ, finely strigosely punctate at its upper edge and with scattered punctures except on the upper vertex which is smooth, frontal carina very marked between the antennæ, which are half as long as the body and wholly testaceous, third joint slightly shorter than the fourth thorax as in *Bakeri*, elytra the same form as the last, shiny, smooth, and very obsoletely punctulate, the basal black marks are about 1 to $1\frac{1}{2}$ mm. long, widest at the base and then gradually drawn to a fine point, the external covers the humeral umbone and the point is drawn down so as to be parallel with the lateral margin, which it nowhere attains, the inner mark touches the scutel and the pointed end is directed to the middle of the disk; the effect of this placing is that the two inner marks appear to be divergent; the feet, under side of the thorax and mesothorax are testaceous.

***Cedionychis branneri* sp. nov.**

Testaceous white, joints 1-3 of antennæ more or less piceous, 3-10 black, thorax with front and rear edges (except the dilated lateral edge) narrowly piceous black, scutel cloudy, elytra with suture very narrowly piceous and on each side 5 piceous black spots as follows: a round dot on the humerus, a slightly larger one immediately behind, near the margin, a larger one to the right of the last and a little towards the base and equidistant between the first two and the suture a transverse bend at the middle, convex in front and barely attaining the suture, and a subquadrate ante apical spot, body beneath cloudy, legs clear testaceous.

Type, Rio Madeira, Brazil 1 length $5\frac{1}{2}$ mm.

Form that of *albipennis* Jac. Head with a transverse frontal foveæ and well marked frontal carina, surface dull and almost impunctate, antennæ a little longer than one half the body, the two apical joints markedly testaceous, thorax with broadly depressed sides and very slightly notched anterior angles, surface impunctate, elytra shiny, very obsoletely punctulate, the apex sparingly ciliate; the three first spots form a triangle of which the apex is the humerus, the middle spot is markedly convex in front, but only slightly convex behind. None of the spots attain the margin and only the extreme end of the middle spot encroaches on the suture. I place the species near *parallina* Jac.

***Cedionychis suffusa* sp. nov.**

Head black, clypeus, labrum and mouth parts falvous, antennæ black, basal joints stained below with piceous, joints 3-4 equal, apical joint fuscous, thorax pale flavous, scutel flavous stained with piceous, elytra pale flavous, with a narrow sublateral piceous stripe, dilated at the apical end into a large ill-defined spot which does not attain either the margin or suture, thorax beneath yellow, rest of body

black, legs pale flavous, the tibiae and tarsi more or less pale piceous and the apex of the hind femora dark.

Type, Rio Madeira 1 probably ♂ length $4\frac{1}{2}$ mm.

Head with a few small punctures near the eye, vertex smooth polished, thorax finely punctulate, sides broadly depressed, anterior angles very obsolete notched, elytra only slightly dilated at the middle, oblong, finely and thickly punctured, the external edge of the piceous stripe is limited by the dilated margin, the internal edge is ill-defined and especially on the ante apical dilation shades gradually into the flavous ground color. The bicolored head with pale elytra and dark edge, and dark apex of the hind femora are the distinguishing features. Seems to be allied to *tabida* Jac. but is much smaller.

PSYCHE

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No. 5

THE GALL MIDGE FAUNA OF NEW ENGLAND.

By E. P. FELT,
Albany, N. Y.

The following list of New England Diptera referable to the Itonididæ has been made possible through the co-operation of a few individuals. Mr. C. W. Johnson and Mr. Owen Bryant have collected in various localities and generously placed their material at our disposal, while Miss Cora H. Clarke has been particularly successful in collecting galls and rearing the adults. The late Dr. M. T. Thompson made noteworthy additions to our knowledge of this group. In addition to the above we have referred to the list of insect galls prepared by Miss Stebbins.¹ This latter includes a considerable number of common species which have also been recorded or observed by other workers.

In view of the fact that nearly 900 species of gall midges are known to occur in America, it can hardly be claimed that the present list of 137 species exhausts the possibilities for New England, though it compares very favorably with the list of forms recorded by us from western North America,² a territory much larger and more diversified than that of New England. The similarities and differences in our knowledge concerning the fauna of these areas is well shown in the following tabulation.

¹ 1910, Stebbins, F A Springfield Mus Nat Hist Bul 2

² 1912, Pomona College Journ. of Ent. 4:753-57.

AMERICAN SPECIES OF ITONIDIDÆ.

Subfamilies or tribes	North America	New England	Western North America
Lestremiinarïæ	29	3	9
Campylomyzariæ	58	4	11
Heteropezinæ	13	2	0
Epidosariæ	70	6	4
Dasyneurariæ	129	21	15
Lasiopterariæ	143	25	22
Oligotrophariæ	86	16	20
Asphondyliariæ	67	16	21
Itonidinarïæ	278	44	20
	873	137	122

A reference to the above table shows a fairly uniform tribal and subfamily representation in the known New England forms. A detailed examination of the list will show that much of our knowledge of *Cincticornia* and *Caryomyia* is due to the work of Miss Clarke. Comparing the New England fauna with that of the western part of the Continent, it will be noted that in the latter, both the *Lestremiinarïæ* and the *Campylomyzariæ* exceed the New England forms by considerable, while no representative of the *Heteropezinæ* has been collected and there is a relatively small representation of the *Itonidinarïæ*. Over half of the known American species have been reared. There is still an immense amount of work to be done along this line and in New England at least, one would expect judicious collecting to result in the discovery of at least a fairly rich fauna in both the *Heteropezinæ* and the *Epidosariæ*.

A considerable porportion of the many forms occurring on *Salix* and *Solidago*³ should be found in New England.

In addition to the species tabulated below, there are some twenty-two names which have been applied to galls collected in New England and which probably represent undescribed forms. These latter names, some of which are valid, are given at the end of the list.

³ Journ. Econ. Entom. 4:468-72.

LESTREMIINÆ

Lestremiinaris.

Catocha americana Felt, Franconia, N. H., Mrs. A. T. Slosson.

C. slossonæ Felt, Franconia, N. H., Mrs. A. T. Slosson.

Lestremia franconia Felt, Franconia, N. H., Mrs. A. T. Slosson.

Campylomyzariæ.

Prionellus dilatata Felt, Worcester, Mass., Dr. M. T. Thompson.

Monardia barlowi Felt, Kingston, R. I., Prof. John Barlow.

M. articulosa Felt, White Mountains, Morrison.

M. modesta sp. nov., New Haven, Conn., H. L. Viereck.

Heteropezinæ.

Miastor americana Felt, Connecticut, Prof. W. M. Wheeler.

Johnsonomyia rubra Felt, Montpelier, Vt., C. W. Johnson, June 1906.

ITONIDIDINÆ

Epidosariæ.

Didactylomyia longimana Felt, Auburndale, Mass., August 1906, C. W. Johnson.

D. capitata sp. nov., North Adams, Mass., August 1907, Owen Bryant.

Colpodia cornuta sp. nov., Jamaica Plain, Mass., October 31, 1910, Miss Cora H. Clarke.

Dirhiza montana Felt, White Mountains, Morrison.

Asynapta frosti sp. nov., Framingham, Mass., June 1, 1910, C. A. Frost.

A. nobilis sp. nov., Bridgeton, Me., August 25, C. W. Johnson.

Dasyneurariæ.

Rhabdophaga salicifolia Felt. Thickened, greenish midrib fold on *Spiræa*. Magnolia, Mass., Miss Cora H. Clarke.

R. batatas Walsh. Irregular, ovoid or subglobular twig gall on willow. Springfield, Mass., Miss F. A. Stebbins.

R. strobiloides Walsh. Pine cone gall on willow, common in New England.

R. brassicoides Walsh. Large, open, rosette or cabbage gall on willow. Springfield, Mass., Miss F. A. Stebbins.

R. gnaphaloides Walsh. Ovate, terminal bud gall on willow. Springfield, Mass., Miss F. A. Stebbins.

- Dasyneura trifolii* Loew. Apposed, deformed, discolored leaflets of sweet clover. Stowe, Mass.
- D. cyanococci* Felt, Stowe, Mass., apical bud gall on blueberry.
- D. clematidis* Felt. Irregular, subglobular bud gall on Clematis. Springfield, Mass., Miss F. A. Stebbins.
- D. parthenocissi* Stebb. Thickened midrib or vein fold on Virginia creeper. Springfield, Mass., Miss F. A. Stebbins.
- D. gleditschiae* O. S., New Haven, Conn., on honey locust, June 1904, B. H. Walden.
- D. americana* nom. nov. (*D. galii* Felt) Magnolia, Mass. Flower bud galls on bedstraw, Miss Cora H. Clarke.
- D. corticis* Felt, Boston, Mass. Small willow twigs, Miss Cora H. Clarke.
- D. seminivora* Beutm. Irregular, deformed fruit of violet. Springfield, Mass., Miss F. A. Stebbins.
- D. salicifolii* Felt, Magnolia, Mass. Young terminal adherent willow leaves, Miss Cora H. Clarke.
- D. ulmea* Felt. Aborted elm buds, Jamaica Plain, Mass., J. G. Jack.
- D. gaylussacii* Felt. Oval, valved midrib gall on cranberry. Springfield, Mass., Miss F. A. Stebbins.
- D. radifolii* Felt, Magnolia, Mass. Oval galls on root leaves of Solidago, Miss Cora H. Clarke.
- D. aromaticæ* Felt, Barre, Mass. Sprigs of mint, Miss Cora H. Clarke.
- D. toweri* Felt, Magnolia, Mass. Enlarged flower buds of *Hypericum mutilum*, Miss Cora H. Clarke.
- D. serrulata* O. S. Apical bud gall on alder. Springfield, Mass., Miss F. A. Stebbins.
- Cystiphora viburnifolia* Felt, Magnolia, Mass. Blister leaf galls on hobblebush, Miss Cora H. Clarke.

Lasiopterariæ.

- L. vitis* O. S. Irregular, tumid, greenish or reddish leaf or tendril gall on grape. Springfield, Mass., Miss F. A. Stebbins.
- L. corni* Felt. Yellowish, purple-margined, blister gall on *Cornus stolonifera*. Springfield, Mass., Miss F. A. Stebbins.
- L. clavula* Beutm. Clavate apical twig gall on flowering dogwood. Springfield, Mass., Miss F. A. Stebbins.

- L. impatientifolia* Felt. Tumid midrib fold on balsam or jewelweed. Springfield, Mass., Miss F. A. Stebbins.
- L. querciperda* Felt. Subcortical swellings on white oak twigs. New Haven, Conn., A. B. Champlain.
- L. farinosa* Beutm. Warty, pruinose leaf gall on blackberry. Springfield, Mass., Miss F. A. Stebbins.
- L. nodulosa* Beutm. Irregular, subcortical stem gall on blackberry. Springfield, Mass., Miss F. A. Stebbins.
- L. galeopsidis* Felt., Boston, Mass. Irregular stem galls on hemp nettle, Miss Cora H. Clarke.
- L. virginica* Felt, Magnolia, Mass. Stem galls on Marsh St. Johnswort, Miss Cora H. Clarke.
- L. convolvuli* Felt. Fusiform stem gall on hedge bindweed. Springfield, Mass., Miss F. A. Stebbins.
- L. cylindrigallæ* Felt. Long, uniform stem swelling on solidago. Mount Tom, Mass., Dr. J. R. Gillett.
- L. solidaginis* O. S. (*tumifca* Beutm.) Irregular or eccentric stem gall on solidago. Worcester, Mass. Dr. M. T. Thompson.
- L. clarkei* Felt, Magnolia, Mass. Whitish, circular blister gall on *Aster macrophyllus*, Miss Cora H. Clarke.
- L. spiræfolia* Felt. Yellowish brown, blister gall on *Spiræa salicifolia*. Magnolia, Mass., Miss Cora H. Clarke.
- Neolasioptera vitinea* Felt, Worcester, Mass. An obpyriform conical, slightly curved petiole gall on grape, Dr. M. T. Thompson.
- N. sambuci* Felt, Worcester, Mass. Irregular stem gall on elder, Dr. M. T. Thompson.
- N. perfoliata* Felt, Worcester, Mass. Stem gall on boneset, Dr. M. T. Thompson.
- N. ramuscula* Beutm., Worcester, Mass. Fusiform stem gall on aster, Dr. M. T. Thompson.
- Asteromyia vesiculosa* Felt, Magnolia, Mass. Oval swellings in aster leaves, Mrs. H. M. Tower.
- A. carbonifera* Felt. Oval, black blister gall on *Salix graminifolia*, Springfield, Mass., Miss F. A. Stebbins.
- A. dumosæ* Felt, Annisquam, Cape Ann, Mass. Inconspicuous blister leaf gall on aster, Miss Cora H. Clarke.
- A. asterifoliæ* Beutm. Yellowish white, dark-margined blister leaf gall on aster. Springfield, Mass., Miss F. A. Stebbins.

- A. flavolunata* Felt. Marginal stem, oval, yellowish blister gall on *Solidago canadensis*. Springfield, Mass., Miss F. A. Stebbins.
Clinorhyncha filicis Felt, Magnolia, Mass. Apparently reared from galls of *Hormomyia verruca* Walsh, Miss Cora H. Clarke.
Camptoneuromyia rubifolia Felt, Magnolia, Mass. Marginal leaf galls on high blackberry, Miss Cora H. Clarke.

Oligotrophiaræ.

- Phytophaga rigida* O. S. Apical, fusiform, beaked gall on willow. Springfield, Mass., Miss F. A. Stebbins.
Janetiella asplenifolia Felt, Worcester, Mass. Fleshy leaf fold near midvein of sweet fern leaves, Dr. M. T. Thompson.
Rhopalomyia clarkei Felt, Tamworth, N. H. Small, fusiform gall on *Solidago* leaves, Miss Cora H. Clarke.
R. hirtipes O. S. Worcester and Springfield, Mass. Globose rootstalk and apical stem galls, Dr. M. T. Thompson and Miss F. A. Stebbins.
R. racemicola O. S. Springfield, Mass. Greenish or reddish, subglobular flower bud gall on *solidago*, Miss F. A. Stebbins.
R. solidaginis Loew., Springfield, Mass. Apical, globular, rosette gall on *solidago*, Miss F. A. Stebbins.
R. anthophila O. S. Green, densely, pubescent, cylindric flower gall on *solidago*. Springfield, Mass., Miss F. A. Stebbins.
R. lateriflori Felt. Axillary bud gall on *Aster lateriflorus*. Springfield, Mass., Miss F. A. Stebbins (*gemmaria*).
R. thompsoni Felt, Worcester, Mass. Globular or ovoid root stalk gall on *Solidago*, Dr. M. T. Thompson.
R. astericaulis Felt, Worcester, Mass. Oval twig gall on *aster*, Dr. M. T. Thompson.
R. pedicellata Felt. Green, red-marked, fusiform, stemmed leaf gall on narrow-leaved *solidago*. Springfield, Mass., Miss F. A. Stebbins (*euthamia*).
R. bulbula Felt, Worcester, Mass. Small bulb-like galls on *Solidago*, Dr. M. T. Thompson.
R. castaneæ Felt, Stowe, Mass. Leaf petiole of chestnut.
R. ? strobiligemma Stebb. Apical or axillary, ovate bud gall on white heath *aster*. Springfield, Mass., Miss F. A. Stebbins.
Sackenomyia virburnifolia Felt, Magnolia, Mass. Purplish vein swellings on *Viburnum*, Miss Cora H. Clarke.

S. packardi Felt, Canton, Mass. Swollen twigs of the long-leaved willow, Winthrop Packard.

Asphondyliariæ.

Asphondylia monacha O. S., Barre, Mass. Apparently unmodified *Solidago* florets, small, apical rosette galls and adherent leaves, Miss Cora H. Clarke.

A. thalictri Felt, Magnolia, Mass. Distorted seed capsules of *Thalictrum*, Miss Cora H. Clarke.

A. ? diervillæ Felt. Distorted fruit of bush honeysuckle. Springfield, Mass., Miss F. A. Stebbins (*inaequalis*).

A. conspicua O. S. Irregular, subglobular apical gall on cone flower. Westville, Conn., Dr. W. E. Britton.

Schizomyia pomum Walsh & Riley. Green or reddish, nut-like, polythalamous bud gall on grape. Springfield, Mass., Miss F. A. Stebbins.

S. coryloides Walsh & Riley. Clustered, fusiform, woolly, pubescent bud gall on grape. Springfield, Mass., Miss F. A. Stebbins.

Cincticornia serrata Felt, Boston, Mass. Circular blister galls on scarlet oak, Miss Cora H. Clarke.

C. caryæ Felt, Worcester, Mass. Probably reared from oak leaf gall by Dr. M. T. Thompson.

C. pustulata Felt, Magnolia, Mass. Pustulate swellings on leaves of black oak, Miss Cora H. Clarke.

C. simpla Felt, Magnolia, Mass. Oval, blister galls on oak leaves, Miss Cora H. Clarke.

C. podagræ Felt, Magnolia, Mass. Narrow, fusiform vein swellings on black oak leaves, Miss Cora H. Clarke.

C. globosa Felt, Magnolia, Mass. Subhemispheric galls on black oak leaves, Miss Cora H. Clarke.

C. pilulæ Walsh, Worcester, Mass. Reddish brown, thick-walled galls on oak leaves, Dr. M. T. Thompson.

C. sobrina Felt, Worcester, Mass. Reared by Dr. M. T. Thompson, probably from oak leaves.

C. connecta Felt, Westville, Conn., Dr. W. E. Britton.

C. pustuloides Beutm. Blister or pustule galls on scarlet and black oak leaves. Springfield, Mass., F. A. Stebbins.

Itonidinarie.

- Contarinia spiræina* Felt, Magnolia, Mass. Bud galls on **Spiræa**, Miss Cora H. Clarke.
- C. pyrivora* Riley, Meriden, Conn., Coe Brothers.
- C. setigera* Lintn., Lowell, Mass. Reared from melon tips.
- C. virginianæ* Felt. Swollen, deformed fruit of wild **cherry**. Stowe, Mass.
- Thecodiplosis dulichii* Felt, Magnolia, Mass. Fruit of *Dulichium*, Miss Cora H. Clarke.
- T. liriodendri* O. S., Boston, Mass. Ocellate leaf galls on **tulip**, Mr. J. G. Jack.
- Dicrodiplosis fulva* sp. nov., Jamaica Plain, Mass. Leaf galls on oak identified as those of *Neuroterus umbilicatus*, Miss Cora H. Clarke.
- D. antennata* Felt, Orono, Me. Larvæ preying on false **maple** scale, *Phenaccocus acericola* King, Dr. O. A. Johannsen.
- D. helena* Felt, Magnolia, Mass. Subglobular galls on **poplar** leaves, Miss Cora H. Clarke.
- Youngomyia umbellicola* O. S. Swollen, unopened florets of **elder**. Springfield, Mass., Miss F. A. Stebbins.
- Aphidoletes cucumeris* Lintn., Lowell, Mass. Reared from lice-infested melon tips.
- Lobodiplosis acerina* Felt, Brookline, Mass. C. W. Johnson.
- L. quercina* Felt, North Adams, Mass., Owen Bryant.
- L. speciosa* sp. nov. North Adams, Mass., August 1907, Owen Bryant.
- Coquillettomyia bryanti* sp. nov., North Adams, Mass., August 1907, Owen Bryant.
- C. dentata* Felt, Greylock Mountain, Mass., August 1907, Owen Bryant.
- Clinodiplosis caulicola* Coq., Portsmouth, N. H. Stems of **Ice-land** poppies, D. W. Coquillett.
- Caryomyia arcuaria* Felt. Smooth, thin-walled hickory leaf **gall**. Worcester, Mass., Dr. M. T. Thompson.
- C. caryæ* O. S. Nearly smooth, thin-walled, yellowish **green or** brown, usually slightly nipped hickory leaf gall. **Spring-**field, Mass., Miss F. A. Stebbins.
- C. inanis* Felt. Thin-walled hickory leaf gall with false **chamber** at the apex. Worcester, Mass., Dr. M. T. Thompson.

- C. persicoides* Beutm. Thick-walled, globose hickory leaf gall with short, curly hairs. Springfield, Mass., Miss F. A. Stebbins.
- C. holotricha* O. S. Thin-walled, globose hickory leaf gall with rather long, rust-red hairs. Springfield, Mass., Miss F. A. Stebbins.
- C. caryæcola* O. S. Conical hickory leaf gall with a long, slender apical process. Springfield, Mass., Miss F. A. Stebbins.
- C. sanguinolenta* O. S. Conical, short, thin-walled hickory leaf gall. Springfield, Mass., Miss F. A. Stebbins.
- C. tubicola* O. S. Cylindric or tubular hickory leaf gall. Worcester, Mass., Dr. M. T. Thompson.
- C. thompsoni* Felt, Worcester, Mass. Hickory leaf gall, Dr. M. T. Thompson.
- Hormomyia shawi* sp. nov., Hampton, N. H., S. A. Shaw.
- H. canadensis* Felt, Magnolia, Mass. Woolly, lipped gall on shadbush leaves, Miss Cora H. Clarke.
- H. johnsoni* Felt, Auburndale, Mass., C. W. Johnson.
- H. clarkei* Felt, Magnolia, Mass. Terminal bud gall on Spiræa, Miss Cora H. Clarke.
- H. verruca* Walsh, Magnolia, Mass. Subconic, clustered galls on willow leaves, Miss Cora H. Clarke.
- H. cincta* Felt, Hampton, N. H., S. A. Shaw.
- H. modesta* sp. nov., Auburndale, Mass., C. W. Johnson, New Haven, Conn., B. H. Walden.
- H. pudica* sp. nov., Hampton, N. H., S. A. Shaw.
- Monarthropalpus buxi* Lab., Kingston, R. I. Blister galls on Box leaves, Prof. E. A. Stene.
- Hyperdiplosis bryanti* sp. nov., North Adams, Mass., August 1907, Owen Bryant.
- Parallelodiplosis spiræ* Felt, Magnolia, Mass. Marginal roll on leaves of Spiræa, Miss Cora H. Clarke.
- P. cattleyæ* Moll., South Natick, Mass. Roots of Cattleya, A. P. Morse.
- P. clarkei* Felt, Magnolia, Mass. Narrow apical bud galls, on Spiræa, Miss Cora H. Clarke.
- Itonida canadensis* Felt, Magnolia, Mass. Woolly, oval vein galls on shadbush leaves, Miss Cora H. Clarke.
- I. spiræina* Felt, Magnolia, Mass. Bud galls on Spiræa, Miss Cora H. Clarke.

I. foliora Rssl. & Hkr., Amherst, Mass. Marginal leaf roll on oak leaves.

I. reflexa sp. nov., Hampton, N. H., S. A. Shaw.

I. rigida Pack., Springfield, Mass., Miss F. A. Stebbins.

A number of galls from which adults have not been reared have been recorded from New England. These deformities have been described and named as follows:

Cecidomyia bedeguar Walsh, *celastri* Stebb., *citrina* O. S., *crotalariae* Stebb., *eupatorifloræ* Beutm., *impatiens* O. S., *lappa* Stebb., *majalis* Bass., *mucosa* Stebb., *niveipila* O. S., *ocellaris* O. S., *pellea* O. S., *poculum* O. S., *potentillæcaulis* Stebb., *pudibunda* O. S., *racemi* Stebb., *reniformis* Stebb., *serotinæ* O. S., *squamulicola* Stebb., *tuba* Stebb., *vena* Stebb., and *rerrucicola* O. S.

A number of, unnamed galls undoubtedly exist in New England territory.

DESCRIPTIONS OF NEW SPECIES LISTED ABOVE.

Monardia modesta sp. nov.

This small midge was taken by Mr. H. L. Viereck at New Haven, Conn., November 4, 1903. It is closely allied to *M. alexanderi* Felt from which it may be separated by colorational characters, the more slender antennal segments and the equal third and fourth palpal segments.

Female. Length, .75 mm. Antennæ hardly extending to the base of the abdomen, thickly haired, fuscous yellowish; 12 segments, the fifth pyriform, with a length one-fourth greater than its diameter and a short, though distinct stem; terminal segment fused with the preceding. Palpi, the third and fourth segments equal. Body a nearly uniform brownish black. Legs mostly fuscous yellowish; claws slender, evenly curved, the pulvilli as long as the claws. Ovipositor lobes triarticulate, the basal segment irregular, trapezoidal, the second quadrate, with a length two and one-half times its width, the third narrowly oval, setose apically. Type: Cecid. 1468.

Asynapta nobilis sp. nov.

The female described below was received from Mr. C. W. Johnson of the Boston Society of Natural History and labeled Bridgeton, Me., August 25. It is easily distinguished from other species of this genus by the long stems of the flagellate antennal segments.

Female. Length, 3.5 mm. Antennæ nearly as long as the body, sparsely haired, dark brown, the stems white; sixteen segments, the fifth with a stem three-fourths the length of the cylindric basal enlargement, which latter has a length twice its diameter and is ornamented with very irregular, reticulate, stout circumfili; terminal segment produced, with a length about four times its diameter, the distal fifth tapering. Palpi; first segment with a length four times its diameter, the second a little longer, broader, the third longer than the second, more slender, the fourth one-half longer than the third, slightly dilated. Mesonotum yellowish brown. Scutellum and postscutellum yellowish. Abdomen sparsely haired, yellowish red. Halteres and coxæ mostly fuscous yellowish, the legs mostly fuscous straw, except the two distal tarsal segments of the anterior and mid legs and the distal three of the posterior legs which are yellowish white; claws slender, strongly curved, unidentate, the pulvilli rudimentary. Ovipositor nearly as long as the body, the terminal lobes triarticulate, the basal subtriangular, the middle subquadrate, the terminal narrowly oval, sparsely haired. Type: Cecid. 1463.

Asynapta frosti sp. nov.

The female described below was received from Mr. C. W. Johnson of the Boston Society of Natural History and bore the following label "Found in jar of sumac twigs and bees nest, C. A. Frost, Framingham, Mass., VI-1, 10." It is easily distinguished from all other known American females by the number of antennal segments. Since the abdomen was recurved dorsally, this species may possibly be referable to the genus *Ruebsaamenia* Kieff.

Female. Length, 1.5 mm. Antennæ extending to the fourth abdominal segment, sparsely haired, dark brown; twenty-two subsessile, cylindric segments, the fifth with a length three-fourths greater than its diameter; terminal segment slightly produced. Palpi; first segment long, slender, second as long as the first, broader, the third fully one-half longer than the second, the fourth about one-half longer than the third, more slender. Mesonotum shining dark brown. Scutellum fuscous yellowish, postscutellum darker. Abdomen thickly haired, whitish yellow. Wings hyaline, costa light straw. Halteres pale straw basally, fuscous apically. Coxæ pale straw. Legs mostly dark straw, posterior tarsi light straw; claws moderately long, stout, unidentate, the pulvilli as long as the claws. Ovipositor long, slender, recurved dorsally, the terminal lobes slender, biarticulate, the basal segment with a length fully four times its width, the distal segment more slender, narrowly elliptical. Type: Cecid. 1424.

Lobodiplosis speciosa sp. nov.

This remarkable male was taken by Owen Bryant, August, 1907, at North Adams, Mass., and may be easily separated from its allies by the two subapical lobes on the basal clasp segment.

Male. Length, 1 mm. Antennæ twice the length of the body, thickly haired, light brown; fourteen segments, the fifth having the basal portion of the stem with

a length one-half greater than its diameter, the distal part with a length two and one-half times its diameter, the distal enlargement constricted at the basal third and with a length nearly twice its diameter; terminal segment, the basal stem with a length five times its diameter, the distal enlargement irregular, with a length three times its diameter and an irregular, fingerlike process equally long. Palpi; first segment irregularly subquadrate, the second nearly twice the length of the first, the third, one-third longer than the second, the fourth, one-half longer than the third, more slender. Mesonotum dark brown. Scutellum and postscutellum fuscous yellowish. Abdomen thickly haired, yellowish brown. Halteres and legs mostly pale straw, the distal tarsal segments somewhat darker; claws slender, evenly curved, anterior unidentate, the pulvilli rudimentary. Genitalia fuscous yellowish; basal clasp segment broad, with a broad subquadrate, subapical, glabrous lobe and apically a tapering, spined lobe; terminal clasp segment long, slender; dorsal plate short, broadly and triangularly emarginate, the lobes tapering to a narrowly rounded, setose apex; ventral plate narrow, long, broadly rounded and thickly setose apically; style long, tapering. Type: Cecid. 1454.

Coquillettomysia bryanti sp. nov.

The midge described below is easily separated from its allies by the broad, white annulations on the tarsi. It was taken by Owen Bryant, August, 1907, at North Adams, Mass.

Male. Length, 1.25 mm. Antennæ probably twice the length of the body, sparsely haired, fuscous yellowish; fourteen segments, the fifth having the stems with a length three and one-half and four and one-half times their diameters, respectively; distal enlargement with a length twice the diameter and a marked constriction near the basal third. Palpi; the first segment with a length three times its diameter, the second a little longer, stouter, the third slightly longer than the second and the fourth, one-half longer than the third, somewhat dilated. Mesonotum reddish brown, the submedian lines, scutellum and postscutellum fuscous yellowish. Abdomen yellowish brown. Halteres yellowish. Legs mostly dark brown, the first tarsal segment and the base of the second, white, the latter and third and fourth broadly annulate with white apically, the fifth white; claws slender, strongly curved basally, the anterior unidentate, the pulvilli about half the length of the claws. Genitalia; basal clasp segment stout, with a short emarginate lobe basally, the margin heavily chitinized; terminal clasp segment slender; dorsal plate short, broad, broadly and slightly emarginate; ventral plate short, tapering, broadly emarginate. Harpes produced as free, strongly recurved, heavily chitinized processes.

Female. Length, 1.25 mm. Antennæ about as long as the body, sparsely haired, fuscous yellowish; fourteen segments, the fifth with a stem about three-fourths the length of the cylindric basal enlargement, which latter has a length two and one-half times its diameter; basal portion of the distal segment cylindric, with a length four times its diameter and apically with a process as long as the enlargement and distinctly swollen at the basal fourth. Mesonotum brownish red. Abdomen brownish yellow. Ovipositor short, the lobes irregularly ovate and thickly setose, other characters practically as in the male. Type: Cecid. 1452, 1453.

Hormomyia shawi sp. nov.

This midge was received from C. W. Johnson of the Boston Society of Natural History and labeled: "VIII-20, 1909 Hampton, N. H., S. A. Shaw 1187." It is allied to *H. consobrina* Felt, from which it is easily separated by coloration and the extremely slender second palpal segment.

Male. Length, 3.5 mm. Antennæ as long as the body, thickly haired, pale yellowish; 15 segments, the fifth having the stems with a length one-half and one-fourth greater than their diameters, respectively. The distal enlargement sub-cylindric, with a length fully half greater than its diameter; terminal segment rudimentary, subglobose. Palpi; first segment stout, with a length about twice its width, the second extremely long and slender, it having a length more than 10 times its diameter. Mesonotum light yellowish orange, submedian lines indistinct. Scutellum and postscutellum yellowish orange. Abdomen thickly haired, pale yellowish, the basal segment and genitalia yellowish orange. Wings hyaline, costa light straw. Halteres yellowish basally, fuscous apically. Coxæ yellowish orange; legs a nearly uniform dark straw; claws slender, evenly curved, the pulvilli rudimentary. Genitalia; basal clasp segment narrowly oval; terminal clasp segment moderately short, stout; dorsal plate broad, roundly and triangularly emarginate, the lobes broadly and irregularly rounded; ventral plate long, broad, subtruncate, slightly emarginate, both sparsely setose. Type: Cecid. 1423.

Hormomyia modesta sp. nov.

This species was taken at Auburndale, Mass., May 22, by Mr. C. W. Johnson of Boston. It may be recognized by the dark brown abdomen and the fourteen cylindric antennal segments, the fifth with a length two and one-half times its diameter and with three circumfili.

Description. Female. Length, 4 mm. Antennæ sparsely haired, fuscous yellowish; fourteen segments, the fifth cylindric, with a length two and one-half times its diameter; sparse whorls of stout setæ occur basally and at the distal third; there are low circumfili near the basal third, the middle and apically; terminal segment slightly produced, with a distinct knob apically. Palpi; first segment short, second with a length three times its diameter, the third a little longer than the second, tapering. Mesonotum smooth, reddish brown, the yellowish submedian lines narrow. Scutellum pale yellowish, postscutellum yellowish, dark brown basally. Abdomen a nearly uniform shining dark brown; ovipositor pale orange; venter concolorous. Wings hyaline. Halteres yellowish basally, fuscous apically. Coxæ, femora and tibiæ mostly a light fuscous yellowish, tarsi fuscous yellowish or dark brown; claws stout, evenly curved, the pulvilli about one-third the length of the claws. Ovipositor short, the lobes broad, tapering to a broadly rounded apex. Type: Cecid. 1346.

Hormomyia pudica sp. nov.

The female described below was received through Mr. C. W. Johnson of the Boston Society of Natural History and labeled June 13, 1907, Hampton, N. H., S. A. Shaw, 1124. It is easily separated from other females having more than eighteen antennal segments, by the three circumfli and the long, uniaarticulate palp.

Female. Length, 5 mm. Antennæ extending to the third abdominal segment, sparsely haired, fuscous yellowish, at least eighteen segments, the fifth with a stem about one-fourth the subcylindric basal enlargement, which latter has a length twice its diameter, is rather strongly constricted near the basal third and bears well developed circumfli basally, near the middle and apically. Palpi; the one long segment is distinctly swollen basally, the distal two-thirds being slender and the total length over one-half the width of the head. Mesonotum dark reddish brown. Scutellum and postscutellum fuscous yellowish. Abdomen mostly reddish brown. Halteres and legs mostly fuscous straw; claws long, evenly curved, the pulvilli about half the length of the claws. Ovipositor short, terminal lobes broadly oval, thickly setose, the ventral lobe roundly triangular. Type: Cécid. 1465.

Hyperdiplosis bryanti sp. nov.

This interesting male was taken by Owen Bryant, August, 1907 at North Adams, Mass.

Male. Length, 1 mm. Antennæ probably one-half longer than the body, sparsely haired, light straw; fourteen segments, the fifth having the stems three and three and one-half times their diameters, the circumfli moderately short. Palpi; first segment rather long, irregular, the second broad, with a length thrice its diameter, the third a little longer and more slender than the second, the fourth nearly as long as the third, somewhat dilated. Mesonotum reddish brown. Scutellum and post scutellum yellowish brown. Abdomen dark brown, the genitalia yellowish. Halteres mostly whitish, slightly fuscous apically. The legs mostly straw colored; claws strongly bent at right angles, simple, the pulvilli a little shorter than the claws. Genitalia; basal and terminal clasp segments moderately long, rather slender; dorsal plate short, deeply emarginate, the lobes apparently narrowly rounded; ventral plate greatly produced, deeply and roundly emarginate—in this specimen, irregularly so; style moderately long, stout. Type: Cécid. 1428.

Itonida reflexa sp. nov.

The male described below was received from Mr. C. W. Johnson of the Boston Society of Natural History and labeled: "I. B. 16, 1906, Hampton, N. H., S. A. Shaw, 1143." This species is easily separated from the allied *I. putrida* Felt by the dark brown abdomen and the somewhat longer antennal stems.

Male. Length, 2 mm. Antennæ as long as the body, thickly haired, dark brown; fourteen segments, the fifth having the stems with a length one and one-

fourth and one and three-fourths their diameters, respectively. Distal enlargement subcylindric, with a length one-fourth greater than its diameter; terminal segment, distal enlargement somewhat produced, irregularly fusiform. Palpi; first segment short, with a length one-half greater than its diameter, the second nearly twice the length of the first, the third a little longer than the second and the fourth three-fourths longer than the third, somewhat dilated. Mesonotum slaty gray, the grayish submedian lines sparsely haired. Scutellum and postscutellum dark gray. Abdomen thickly haired, dark brown. Wings hyaline, costa light straw. Halteres yellowish basally, fuscous apically. Coxæ and femora mostly fuscous yellowish; tibiæ and tarsi mostly dark brown; claws moderately stout, strongly curved, the pulvilli shorter than the claws. Genitalia; dorsal plate deeply and triangularly divided, the lobes narrowly triangular; ventral plate broad, broadly and roundly emarginate. Type: Cecid. 1422.

A VERNAL BEE (*COLLETES INÆQUALIS* SAY).

BY JOHN H. LOVELL,
Waldoboro, Maine.

In Mr. Frost's interesting note on *Tricrania sanguinipennis* Say, which was published in *PSYCHE*, December, 1912, the name of the bee near whose burrows the beetles were found is given (through an inadvertence on my part) as *Colletes compactus* Cr., when it should be *C. inæqualis* Say. The two species, while bearing a general superficial resemblance, may be distinguished by the difference in the sculpturing of the enclosure on the metathorax or prepodeum; and by the fact that the former is an autumnal species and the latter a vernal species, some three months intervening between the disappearance of *C. inæqualis* and the appearance of *C. compactus*.

I have this season received both sexes from Mr. Frost, to whom I am indebted for the following notes. The bees were abundant, and had constructed numerous burrows near the base of a sloping embankment, about three feet high, sparsely covered with grass. There were also nests where the ground was level and free from vegetation. As the burrows appeared to be unlined and the soil was sandy it was impossible to follow the tunnels to a depth of more than three or four inches. This species of *Colletes* in New England is on the wing for about two months, and is most commonly taken on the aments of the willows. Mr. Frost captured

his first specimens on March 23, and on the 30th observed many visits to the flowers of *Salix*. On March 31 a female was seen looking out from the mouth of nearly every burrow, probably waiting for a warmer temperature, for on April 6, when there was a severe snow squall, no bees were seen flying about the burrows; and a few which had ventured to fly to the willows were numbed by the cold.

Swenk states that he examined a female from Durham, N. H., taken Oct. 5, 1899, and has also seen a few other autumnal specimens of *C. inaequalis*. He regards them as individuals appearing prematurely, which normally would not have come out until the following spring.¹

Colletes compactus flies in New England from about the first of September to the middle of October. I most commonly find it on the inflorescence of the goldenrod, but have one specimen taken on the flowers of *Aster puniceus*.

THE LIFE HISTORY AND HABITS OF *SPALANGIA MUSCIDARUM* RICHARDSON, A PARASITE OF THE STABLE FLY.²

BY HARRY PINKUS.³

Bureau of Entomology, United States Department of Agriculture.

During the summer of 1912, while assisting in the study of the life history of the stable fly (*Stomoxys calcitrans* Linn.), at least two species of parasites were found breeding in large numbers in the puparia of this fly. These parasites belong to the family Pteromalidæ. One has been determined by Mr. C. H. Richardson as *Spalangia muscidarum* Richardson; the others have not been definitely identified. *S. muscidarum* was found most abundant while the other species appeared in smaller numbers. They appear to have similar breeding habits, although little has been done on the undetermined species.

During the investigation of the stable fly a lot of oat straw placed in a pan and kept moist, was placed in the laboratory yard

¹ ("Specific Characters in the Bee Genus *Colletes*," Contributions from the Dept. of Ent., Univ. Neb., No. 1, p. 32)

² Published by permission of the Chief of the Bureau of Entomology.

³ Deceased August 27, 1913, at Dallas, Texas.

near the stable. When the straw began to decay stable flies visited it in large numbers, depositing thousands of eggs. In addition to the stable fly, a number of other species were found to be breeding in this rotting straw, such as Phoridae, Chironomidae and Anthomyidae. No house flies (*Musca domestica* Linn.) or any other species of flies which commonly breed in dung were found although *Musca domestica* was present in the vicinity in considerable numbers. In a few weeks great numbers of *Stomoxys* larvæ of various sizes, as well as pupæ, were found in the straw. At this time a screened cage was placed over the pan in order to collect the flies as they emerged. Numbers of flies appeared daily for some time but the number was observed to diminish noticeably later. Upon examination of the straw the majority of the *Stomoxys* pupæ were found rather dark in color, some being almost black. When the cephalic ends of these pupæ were broken off in some cases the pupæ of parasites were found to be contained within, and in others the adult parasites came out as soon as the pupæ were broken. Considerable numbers of the *Stomoxys* pupæ were dead but no parasites were found within them. These pupæ were in the form of a soft, whitish, malodorous mass. The death of these pupæ appeared to be due, in part at least, to the parasites, as will be explained later.

Spalangia muscidarum Richardson appears to have a wide distribution. It has been bred from the house fly by Mr. C. H. Richardson, Jr., near Boston, Mass., as well as by Doctor L. O. Howard at Washington, D. C., from the same host. During this investigation, adults emerged on October 7, 1912, from *Stomoxys* pupæ collected by Mr. F. C. Bishopp at Gainesville, Texas on September 6, 1912. Other adults began emerging on October 26, 1912, from puparia collected by F. C. Bishopp and E. O. G. Kelly at Wellington, Kansas, on September 21, 1912, and others appeared on January 15, 1913 from puparia collected October 25, 1912 by F. C. Bishopp at Addis, Louisiana. Numbers have also been bred from pupæ collected at Denison, Texas, December 6, 1912. As has been pointed out, the parasite is undoubtedly very common in the vicinity of Dallas, Texas.

At Dallas the breeding was conducted both in the laboratory and out of doors. In the latter situation some adults emerged at

different times during the winter. These adults were killed when a temperature of 28° was reached on January 2, 1913. The immature stages, however, remained in perfect condition throughout the cold weather, and undoubtedly large numbers will emerge in the spring. In the laboratory, emergence continued throughout the winter. The greatest number appeared from pupæ kept in glass tubes in a well heated room. In another room, in which the temperature ranged somewhat lower, emergence was less rapid. At temperatures from 55 to 60° F. the adults became inactive. Breeding progresses well at 70° and somewhat higher temperatures increase all activities. Adults kept at 110° (in the dry atmosphere of an incubator) died very quickly.

HABITS.

The adult parasites are scavengers in habit. In cages no prepared food is necessary for them. They prefer to feed on the remains of the host, and very often crawl back into the puparium and stay there for some time. While within the puparium they have been observed to feed upon the remains of the dipterous pupæ although honey and water were at hand. In no case did the adults pay much attention to artificial foods. They are seldom found anywhere except in and around the breeding places of their hosts. In flight the body is held in a vertical position with head up and wings extended horizontally. When disturbed, both sexes have the habit of "possuming." The legs are drawn together and the insect drops for a few seconds and then quickly resumes activity in order to escape. It appears that the parasites remain in one place as long as they have plenty of fly pupæ to parasitize. Probably dispersion takes place when the parasites become numerous and they do not have a sufficient number of hosts. It has been found that each female requires a considerable number of pupæ in which to deposit her eggs.

After the adults emerge from their pupal skins they have the habit of remaining within the puparia of the host for some time. During this period they gnaw more or less regular, circular holes through the puparia, but in many cases do not issue for some time after the emergence holes have been made.

Copulation takes place very shortly after emergence. The males are ever ready for mating. They seize the females and cling to their backs, caressing them with their antennæ for some time until the female exposes the ovipositor and copulation takes place. This act has been observed to take place a number of times at short intervals. Often two or three males endeavor to secure the attentions of the female at the same time.

OVIPOSITION.

Spalangia muscidarum is a simple parasite¹ and does not usually deposit a second time in a single host. When a female finds a pupa she first makes a thorough examination with the antennæ and then fixes herself firmly on the pupa. She then begins to feel about on the pupa with the tip of the ovipositor, sometimes changing her position if the first spot attacked is too hard for penetration. The ovipositor is usually inserted near the cephalic end of the puparium, generally on a suture. While ovipositing, the female is not easily disturbed. In some cases the puparium may roll over and yet the parasite retains her position. The accompanying figure (Plate I fig. 1.) of the female in act of depositing was drawn from a photograph taken by Mr. H. P. Wood. About ten or fifteen minutes are required for the deposition of an egg.

Repeated efforts to induce the female to deposit an egg in a puparium which had already been deposited in were unsuccessful. In every case the female quickly recognized the fact that the puparium had already been attacked, and left it in search of other hosts. A female which was supplied with fresh pupæ as fast as oviposition took place was observed to deposit in fifteen different pupæ in succession. She would have, undoubtedly, deposited in many more pupæ had they been supplied, as she appeared strong and active after having laid these eggs. Subsequent examination of these fifteen puparia showed that immature parasites were developing in four and all of the others were dead, probably as the result of the insertion of the ovipositor. When numbers of puparia were supplied to parasites in cages, in only one case did an adult fly emerge, the others having succumbed to the attack of the parasites.

¹ Pierce: On some phases of parasitism displayed by insect enemies of weevils. Journ. Econ. Ent., vol. 3, p. 452, 1910.

The female will readily oviposit in many species of dipterous pupæ. Evidently it has no preference. In addition to *Stomoxys calcitrans* the following species have been parasitized experimentally: *Musca domestica* Linn., *Hæmatobia serrata* Desv., *Helicobia quadrisetosa* Coq. and *Pseudopyrellia cornicina* Fabr. In one test a number of puparia of different species of flies were mixed with those of *Stomoxys calcitrans* and all were put under a glass bell jar in the laboratory. A number of parasites were introduced and observations made in order to ascertain if any preference was shown. In this case, as well as when different pupæ were placed in small tubes with parasites, no discrimination between the different species was apparent.

In nature the stable fly is undoubtedly the principal host of the parasite. This is evidently due to the breeding habits of this fly. As has been stated, the stable fly breeds largely in rotting straw or manure which contains much straw. The loose texture of this material allows the parasites to gain access to the puparia with ease. On the other hand, the breeding habits of the species which have been found experimentally to act as hosts of this parasite, are quite different. For example, *Musca domestica*, *Hæmatobia serrata* and *Helicobia quadrisetosa* breed mainly in dung or other matter which is of compact texture. By the time the larvæ are ready to pupate the material in which they are breeding becomes quite compact. This prevents, to a great extent, the adult parasites from entering the substance in order to reach the host, except when the mass of breeding material is accidentally scattered or if some straggling specimens happen to pupate so as to be partially exposed. In nature this condition is not the rule, hence we find the parasite attacking most commonly those species which are readily reached.

DEVELOPMENT.

The length of the developmental period of the parasite varies greatly, according to the temperature experienced. An egg (see Plate I fig. 2) which was probably of this species has been removed from the body of a fly pupa. A number of observations have been made to determine various points in the developmental period of the parasite.

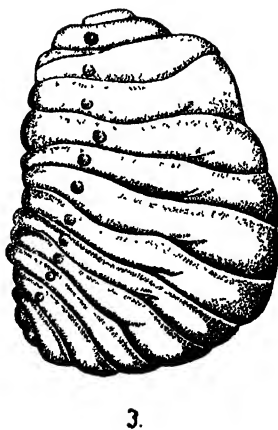
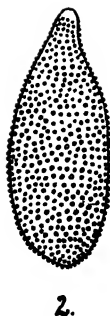
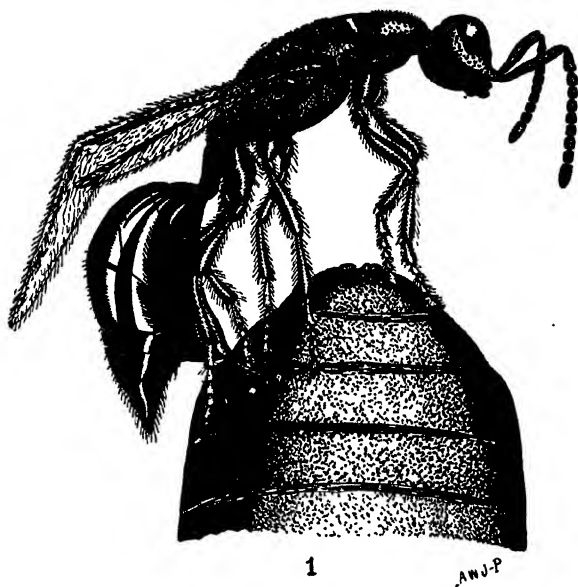


Fig. 1. *Spalangia muscidarum* Richardson. Adult female ovipositing in puparium of *Stomoxys calcitrans* Linn. Fig. 2. Egg of *Spalangia muscidarum*. Fig. 3. Larva of *Spalangia muscidarum*. Fig. 4. Pupa of *Spalangia muscidarum*.

In one series, eggs were deposited on November 7, 1912 within the puparia of *Stomoxys calcitrans*. On November 12 one fly pupa was observed to have a minute larva feeding on its eye. On December 9 full-grown parasite larvæ (see Plate I, fig. 3) were found feeding on the exterior of fly pupæ within the puparia. One parasite pupa (see Plate I fig. 4) was also found on this date. January 30, 1913, one adult parasite emerged, thus having a total developmental period of 84 days. During this period the average mean temperature was 56.58° F.

A number of puparia of *Musca domestica* were exposed to *Spalangia* adults November 3, 1912. On November 9 the parasites were observed to be ovipositing. In at least two of these the parasites were observed to have pupated when examined December 6. When again examined, on January 9, 1913, the pupæ were becoming black. Three adults had issued on or before February 20, 1913. In this test the total developmental period was less than 109 days. In another experiment, in which *Musca domestica* was used as a host, parasites were placed with the pupæ on November 12, 1912. Oviposition occurred at noon on this date. Full grown parasite larvæ were found on January 5, 1913, and on January 30, some had begun to pupate, thus having occupied 79 days in developing to the pupal stage at about the same temperature which prevailed in the above experiment where *Stomoxys* pupæ were used. One female parasite issued February 26, 1913, after a total developmental period of 106 days.

Parasites developed from the egg to the adult in 100 days in puparia of *Hæmatobia serrata*. In this test deposition took place on November 12, 1912. Pupation began January 30, 1913 and the first adult emerged February 20, 1913. This experiment was also conducted in the same room as the preceding experiments.

In another room in the laboratory, where the temperature was considerably higher, a number of puparia of various species were exposed to parasites on November 30, 1912. Pupation had begun January 30, 1913, or 61 days after eggs were deposited. This shows that the period from deposition to pupation was shortened 18 days by the higher temperature in which the developing parasites were kept. One adult female and one male emerged February 26, 1913 from a *Hæmatobia serrata* puparium. The total developmental period is therefore about 88 days.

Examinations of puparia kept out of doors during the winter of 1912-13 showed that a few adults emerged during warm weather but the majority of the immature stages appeared to continue developing very slowly and will probably not emerge until the advent of spring.

METHODS OF ARTIFICIAL PROPAGATION OF PARASITES OF THE STABLE FLY.

As has been shown, the habits of the female parasites enable them to destroy a great number of fly pupa. Many of these pupæ are destroyed by the development of the young parasites and others died, apparently from injury caused by the insertion of the ovipositor. Circumstantial evidence also indicates that many fly pupæ are pierced by the ovipositor to cause juice to exude from the punctures for food for the parasites. This view is strengthened by the finding in nature of numerous *Stomoxys* puparia, the contents of which have completely dried up.

It would seem that if an adequate number of these parasites are present early in the season they would be quite effective in the control of the stable fly. However, under natural conditions it is reasonable to assume that in general there is seldom a sufficiently great number of parasites present to cope with *Stomoxys*, despite the fact that the fly generally occurs in small numbers early in the spring. The development of the stable fly is considerably slower than that of the house fly and as a consequence it seldom becomes sufficiently abundant to be very injurious until in the fall. The development of the parasites is slower than that of the stable fly, hence under natural conditions the parasites are unable to control it. However, late in the fall the parasite also becomes very abundant as breeding is facilitated by the great abundance of its hosts and the high temperature which prevails at that season. With the advent of cold weather the breeding of both the parasite and host is checked to a great extent and when fatal temperatures are reached nearly all of the adult parasites are killed without having had an opportunity to deposit in the fly puparia which are still present in rotting straw and other places. This condition allows many stable flies to continue to develop through the winter and appear as adults the following spring. Those which were in

the larval stage at the time the adult parasites were destroyed would be entirely exempt from attack as well as some of the pupæ which had not been reached up to that time. Of course the parasites which are in the immature stages would be protected by the same conditions which protect the host and they would pass the winter successfully and emerge along with the flies in the spring. However, their numbers would be much smaller than the stable fly at that time.

By artificial means it is possible to propagate these parasites in large numbers throughout the winter and liberate them early in the spring. By this procedure it might be possible to cut down to a great extent the first generation of flies and the continued development of the parasites during the spring and summer would tend to control the flies throughout the year. In addition to the destruction of the stable fly, house flies and other injurious species would also be attacked whenever the parasites are able to reach them.

Since *Spalangia* does not discriminate between various species of fly puparia the work of artificial propagation is greatly facilitated. The writer has found it best to collect the larvæ together with the manure or other substances in which they are breeding and after pupation has taken place to separate the pupæ and supply the parasites with them.

The writer has modeled a parasite breeding cage (Fig. 1) which he finds quite practical for the breeding of these parasites. In the construction of this cage an empty honey box (the container of comb honey) size 8 x 14 x 9½ inches in height is used. Glass is closely fitted in the front and top and a hole four inches in diameter is cut in either end. Around the inside edge of each of these holes is tacked one end of a cuff of soft muslin cloth. These cuffs should be about nine inches in length, the outer end being gathered with an elastic so as to closely fit around the wrist of the operator when the hands are inserted into the box. When not in use the cuffs are closely tied with a string to prevent the escape of parasites. At the center of the bottom of the cage a hole one inch in diameter should be cut. The entire bottom of the cage, with the exception of the circular hole, is then covered with oil cloth to protect the wood from the moisture. On top of the oil cloth a

layer of white blotting paper is placed, completely covering the bottom of the cage. A narrow strip of this paper should be sewed to the large blotter in such a position as to extend through the hole in the bottom of the cage into a vessel beneath which contains

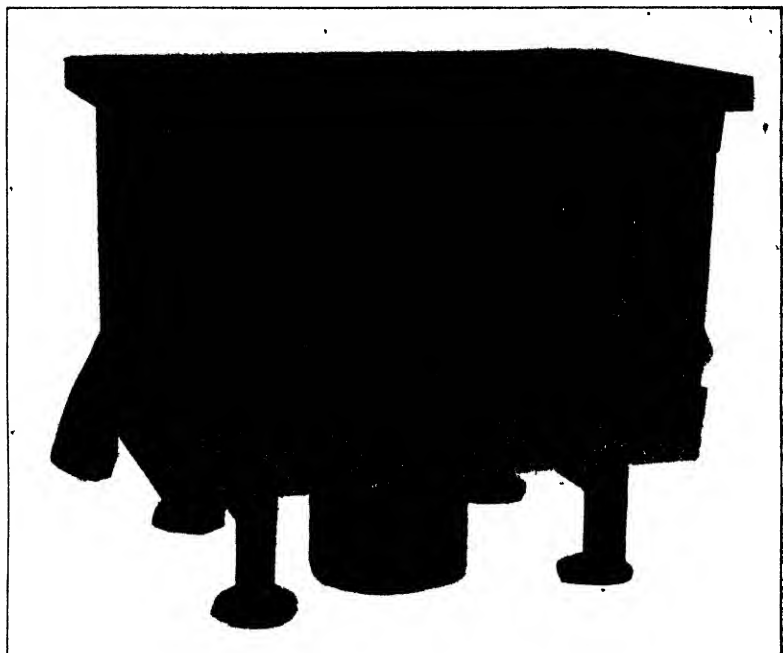


Fig. 1. Parasite breeding box (original).

water. The strip of blotter takes up the water from the container and keeps the large blotter which lies in the bottom of the cage moist at all times. Four legs of a convenient height are attached to the corners of the cage and placed in cups to keep away ants and mites. These legs were $3\frac{1}{2}$ inches long in the cage used in this work. A small amount of damp straw is then placed in the cage on the blotter.

When the cage is in readiness the parasites, either in the adult or pupal stage, are introduced. If adult parasites are put into the cage the pupæ from which they emerged should always accompany them in order to furnish protection and food. Unparasitized

pupæ should then be introduced from time to time to insure having an abundance of fresh material for the parasites to attack. It is very essential that the cage be kept in direct sunlight, for at least part of the day, and in a warm room. A temperature of 75 to 80° F. is desirable. In a week or two after the first pupæ have been exposed to the parasites they should be gathered together and placed in a separate place and more fresh pupæ added. The original stock of parasites should be secured by collecting puparia in localities where the parasites are known to occur in greatest numbers. Where great numbers of pupæ can be obtained they may be placed together. To facilitate the separation of the puparia from the material in which they pupated, and to eliminate the dead pupæ, they may be placed in a vessel of water. All of the living or parasitized pupæ float and may be removed with a section lifter or a skimmer. A parasitized pupa can be quite readily recognized by its being much darker than normal and by one side of the puparium appearing almost black while the other portion is somewhat translucent and of lighter color. These puparia should be placed in glass tubes containing a very humid atmosphere and kept in a warm room. As the parasites emerge they should be transferred into breeding boxes as described above.

When a sufficient number of parasites has emerged to proceed with breeding the other puparia parasitized in the cages should be examined. When it is found that most of the parasites are in the pupal stage the entire lot should be removed to a refrigerator or cold storage room in which the temperature is kept uniformly between 50 and 55° F. These temperatures check development and retard emergence a few weeks before it is planned to liberate the parasites in the field. The puparia should be removed from the refrigerator so they may complete their development. Parasites should always be liberated near barns or straw stacks where flies are known to be breeding.

The developmental period can be shortened greatly, probably less than half the time required in the experiments reported herein, by increasing the temperature under which they are propagated. Under natural conditions breeding must be greatly stimulated by the heat produced by rotting straw and manure which surround the parasitized puparia.

By the plan of artificial propagation herein outlined and liberation of large numbers of parasites early in the spring where it is desired to carry on a campaign against the stable fly, we can reasonably expect them to be an important factor in the control of this pest.

A NEW GENUS OF MALLOPHAGA.¹

BY JOHN HOWARD PAINE.

Bureau of Entomology, United States Department of
Agriculture.

Through the kindness of the United States Biological Survey, the writer has been able to make a collection of Mallophaga from bird skins taken in Panama. Among the resulting specimens is a most curious form which is not referable to any of the known genera, and for which, therefore, the founding of a new genus becomes necessary.

Ancistrocephalus gen. nov.

A single male specimen was taken from the skin of a ground dove, *Chamepelia rufipennis* (Rio Indio, Canal Zone, March 3, 1911). In this specimen the antennæ show but three segments, being most probably due to the loss of the terminal two. This is borne out by the fact that the tip of the third segment, under high magnification, appears unfinished, as though other segments had been attached. The genus therefore, having two-clawed tarsi, falls into the family *Phlopteri*dæ. Following are given the characters of the genus:

Small species with head broader than long and bearing extremely long hairs on the head and body; these hairs are the longest I have seen on any Mallophagan. Front broad, flattened, almost straight, with lateral angles produced into long, curved, heavily chitinated backward projecting hooklike appendages. Antennæ well developed, in the male at least, and arising from deep lateral emarginations, situated before the middle, affording a certain resemblance to some of the mammal infesting genera. Temples squarish, bearing extremely long hairs; occiput broad, almost straight. Abdomen broad, segments with posterior lateral angles produced into slightly curved, chitinated processes, giving the lateral edges of the abdomen a highly serrate appearance. Last segment in male entire.

¹ Published by permission of the Chief of the Bureau of Entomology.

Ancistrocephalus kelloggi sp. nov. (Fig 1.)

A single male specimen taken from the skin of a ground dove, *Chamepelia rufipennis* (Rio Indio, Canal Zone, March 3, 1911)

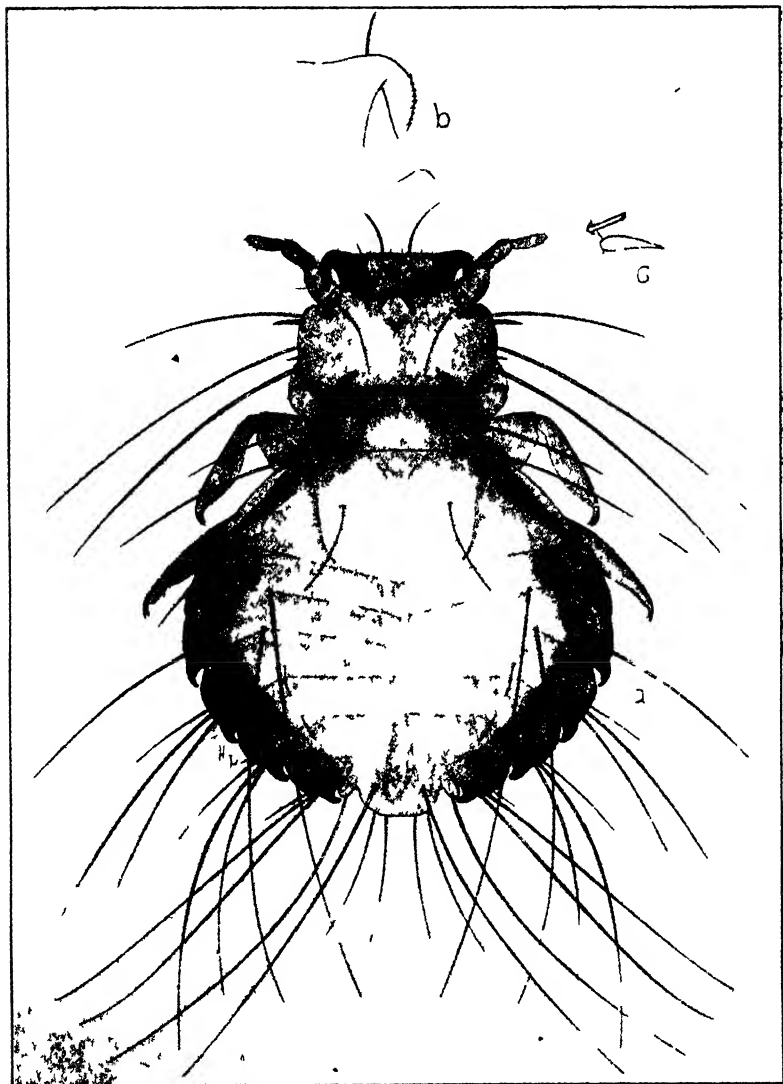


Fig 1. *Ancistrocephalus kelloggi* sp. nov., male a, dorsal view, b, anterior lateral angle of head, c, lateral spine on head

in the collection of the Biological Survey, United States Department of Agriculture, at the National Museum. A minute species with short, broad body.

Description of male: Head two-thirds as long as broad. Front flattened, almost straight, set in between the prominent hook-like anterior lateral angles; these angles projecting forward slightly beyond the clypeal front, are heavily chitinized and bent backward to form sharp hooks with finely serrated outer margins (Fig. 1, *b*). Front between hooks with a narrow marginal band bearing four hairs on each side, the second from the center being the longest; also several hairs projecting from the ventral surface, not shown in the figure, and a hair on the anterior extremity of the lateral hooks. A hair on each side on the dorsal surface near the anterior margin, another in front of the antennæ and a longer one near the inner extremity of the lateral emarginations. Sides of head before the middle deeply emarginate for the reception of the antennæ. Antennæ long, first segment enlarged, about as long as the second, with third a little shorter and diminishing in thickness; last two segments missing. Antennal bands forming the basal marginal portion of the lateral hooks. Eyes indefinite, located on the anterior, forward projecting angles of the temples with a small ocular fleck. Ocular blotch small, colored. Temples squarish, but little rounded and slightly narrowing behind; one very long marginal hair just behind the eye and two still longer ones arising about half way back, these latter reaching onto the third segment of the abdomen; a short spine near the posterior angle, another between the two long hairs just mentioned, and a peculiar, long, heavy spine just behind the anterior hair (Fig. 1, *c*). Occiput broad, straight, with broadly separated occipital blotches; two hairs on each side, the outer, shorter one near the lateral angles of the head; occipital bands and signature absent.

Thorax long, slightly wider than head. Prothorax with sides straight, diverging, and posterior margin rounded at the sides but straight across the middle. Lateral angles probably with a long hair, broken off in the specimen at hand, leaving definite pustule. Metathorax quadrilateral with anterior lateral angles protruding, bearing two prominent pustules from which the hairs have been broken; this segment much narrower than the first segment of the abdomen and embraced by it, extending to its posterior margin and dividing it into two lateral, triangular portions; posterior margin of metathorax not visible. A dorsal hair on each side, midway between the anterior and posterior margins. Legs with femora broad, those of hind legs not projecting beyond the sides of the abdomen, their articulation being well in toward the meson; tibiæ long and narrow.

Abdomen circular, a little wider than long, widest at third segment, with broad lateral bands and faint transverse blotches. Posterior lateral angles of segments two to six produced into a chitinized, slightly in-curved appendage which extends inward and forward as an internal chitinized band to the anterior margin of the segment. First segment longest with uncolored, diverging sides; seventh segment much reduced, shorter than the preceding one and bearing a very long hair; last segment rounded, entire, bearing two very long hairs on the dorsal surface and four shorter ones on the posterior margin. Segments three to six with very long lateral hairs arising before the lateral appendages. An extremely long dorsal hair on the

posterior margin on each side of segments two and three, situated a short distance in from the lateral bands and extending far beyond the end of the body; others very small, occupying similar positions on segments four and five; these appear to be the only dorsal hairs. Genitalia with long, slender external appendages, not heavily chitimized.

Measurements:		
	♂, length 1.000 mm.	Width
Head	.246	.344
Prothroax	.100	.278
Metathroax	.196	.360
Abdomen	.623	.754

NOTES ON THE DURATION OF THE PUPAL STAGE IN CERTAIN LEPIDOPTERA.

BY PHIL RAU.
St. Louis, Mo.

1. *Grapta interrogations* Fab.

The larvæ of this insect were observed upon their food-plant, the hop vine, from the time of pupation to the time of emergence as adults, covering the period from August 28 to September 21, 1910. The duration of the pupal period was as follows:

Days.	No. of insects.
9	1
10	6
11	2
12	0
13	2

We see that in these eleven individuals this period varied from 9 to 13 days, in most of them 10 days. Mr. W. H. Edwards¹ finds that the duration of the pupal stage at Coalburgh, West Va., is from 7 to 11 days, a little shorter than at St. Louis.

2. *Samia cecropia* Linn.

The notes on three insects of this species are as follows:

Sex.	Date of pupating.	Date of Emerging.	Duration.
♂	7/20/'10	6/3/'11	318 Days.
♀	7/27/'10	6/5/'11	313 "
♀	7/15/'11	6/4/'12	324 "

¹ Can. Ent. Vol. XV. p. 204.

The cocoons were on trees, exposed to the natural weather conditions of St. Louis during the winter .

3. *Telea polyphemus* Cramer.

Four larvæ of this species taken in the woods spun their cocoons within three or four days after being caged, and emerged as follows:

Sex.	Pupated.	Emerged.	Duration.
♂	9/19/'10	5/12/'11	235 Days.
♀	9/22/'10	5/13/'11	233 "
♂	9/23/'10	5/16/'11	235 "
♂	9/27/'10	5/11/'11	226 "

At first glance the figures above seem to show that the insects emerged in the order in which they pupated, but in the fourth instance we see that the individual which was the last to pupate emerged as an adult before any of the others.

It would be of interest to record similar data from year to year from one or more localities, in an attempt to discover the causes underlying any variation in the duration of the pupal period, and to discover if the pupal duration is in any way correlated with the longevity of the imago. We have found in connection with other work that the pupal period of the *Cecropia* moth varied greatly under changed conditions of temperature and moisture.

ST. LOUIS, Feb. 21, 1913.

NOTES ON VARIATION IN THE VENATION OF THE SPECIES OF THE GENUS *LEPTOGASTER*.

BY CHARLES W. JOHNSON.

Boston Society of Natural History, Boston, Mass.

In *The Entomologist* for July, 1913, vol. 46, p. 213, under the title "A Fossil Asilid Fly from Colorado," Prof. T. D. A. Cockerell proposes *Tipulogaster* "a new subgenus (or genus?)" for the recent *Leptogaster badius* Loew, based on the following characters: "The anal cell is narrowed apically as in *L. hellii* but the second posterior cell is no more produced basally than in *Cophura*. This also has the second submarginal cell shorter than in the typical *Leptogaster*. while the distance between its base and the anterior

cross-vein is much greater." To one having a large series of *L. badius* or a large number of the species of *Leptogaster*, the attempt to make a genus or even a subgenus on such trivial characters shows that the author had very little material at his command and had no idea how variable these characters are even in the same species.

Anal cell. The fifteen specimens of *L. badius* before me show the following variations: twelve females have the anal cell narrowed but varying from one in which the cell is very narrow and almost closed on one wing, to others in which the outer portions of the veins are almost parallel; in two males they are parallel, as in the typical *Leptogaster*.

In *L. testaceus*, a closely related species, three have the venation as in *L. badius* and two have the anal cell closed. In *L. incisularis* Loew, the anal cell is only slightly narrowed at the margin. *L. annulatus* Say, *marinus* and *flavipes* Loew, *virgatus* Coq., *claripes* and *obscuripennis* Johns., and *atrodorsalis* Back., all have the anal cell as in the type of the genus *L. cylindrica* DeG. (*L. tipuloides* Fabr.). On the other hand, in *L. brevicornis* and *pictipes* Loew, and *floridensis* Johns., the sixth longitudinal and the anal veins are widely divergent and consequently the anal cell is widest at the margin of the wing.

Second posterior and second submarginal cells. Here again we find all gradations between the type species and *L. badius*. *L. annulatus* and *atrodorsalis* which have typical anal cells, have the second posterior cells "less produced basally" than in *L. badius*; the former however, has a long second submarginal cell and the latter a short one. In *L. murinus*, *claripes*, *obscuripennis* and *virgatus*, the base of the second posterior cell is produced almost as much as in *L. cylindrica* but the second submarginal cell is as short as in *L. badius*. In the species with broad anal cells, *L. pictipes* and *floridensis* have the second posterior cell scarcely produced basally, the former has, however, a short and the latter a long second submarginal cell, while in *L. brevicornis* the second posterior cell is strongly produced basally and the second submarginal cell is long. The variation in the length of the second posterior cell was pointed out by Dr. E. A. Back (Trans. Amer. Ent. Soc., XXXV, 157, 1909). In referring to what he terms the anterior intercalary

vein, he says: "In some species the venation mentioned is inclined to be variable in different or even in the same specimen."

Another variable character is referred to in Dr. Back's key to the species as "fourth posterior cell petiolate at the base or fourth posterior cell sessile or subsessile." *L. pictipes* may be either sessile, subsessile or with a short petiole. *L. annulatus* shows a similar variation although more rarely petiolate. One specimen of *L. pictipes* has the discal cell open on the left wing and another has an adventitious cross-vein in the second submarginal cell of the left wing. A specimen of *L. badius* and another referred doubtfully to *L. incisularis*, have a similar vein in the second posterior cell on the left and right wing respectively. An undetermined species has an adventitious cross-vein in each of the second posterior cells, and one in the second submarginal cell of the left wing. These examples are given to show possible mutations. The type of *L. badius* has the basal third of the wings subfuscus. This is only distinctly marked in one of the fifteen specimens.

THE LIFE HISTORY OF *THRYPTICUS MUHLENBERGIE* SP. NOV. (DIPTERA).

BY O. A. JOHANNSEN AND C. R. CROSBY.

Cornell University, Ithaca, N. Y.

On April 21, 1909, while examining some *Muhlenbergia sylvatica* on the shaded bank of Cascadilla Creek near the Cornell University Campus, Ithaca, N. Y., we noted that many of the stems were broken squarely off. The tip of the cavity was plugged with frass, and in each case a slender dipterous larva was found just below the plug. A number of these larvæ was taken from the straws and placed on cotton in a vial for rearing. By May 4, pupation has taken place. An adult fly was found alive on May 29. Again on May 5, 1910, similar pupæ were found in *Muhlenbergia* stems that had been collected about two weeks previous. Adults emerged from this material on May 24.

The flies were at first thought to be *T. willistoni* which they closely resemble, but subsequent study has convinced us that they are a new species. In order to get fresh material in all stages

upon which to base our descriptions, we again visited in April of the present year, the spot where the former specimens were found. From the larvæ then collected we reared three females and one male May 16-19, 1913. Nothing was learned of the eggs nor the manner of oviposition, but judging from the form of the ovipositor of the female it seems likely that the eggs are laid within the stem plant, probably in May, and that the larva remains thus within the stem until the time of pupation in April of the following year.

Larva (fig. 1). Length, $5\frac{1}{2}$ to 6 mm. Peripneustic. Very pale amber yellow, pharyngeal skeleton dark brown. The combined head and thoracic segments somewhat conical in shape, not differentiated. Abdomen with nine illly defined segments, the anterior ones of greatest diameter, the intermediate longer than wide, anal segment with a prominence on the ventral side, each of the others with a ventral transverse band of ambulacral setulæ, each band consisting of 12 to 15 strong setulæ followed by 2 or 3 rows of more minute ones. The pharyngeal skeleton (figs. 2 and 3) consists of a transverse saddle-like structure anterior to which is a pair

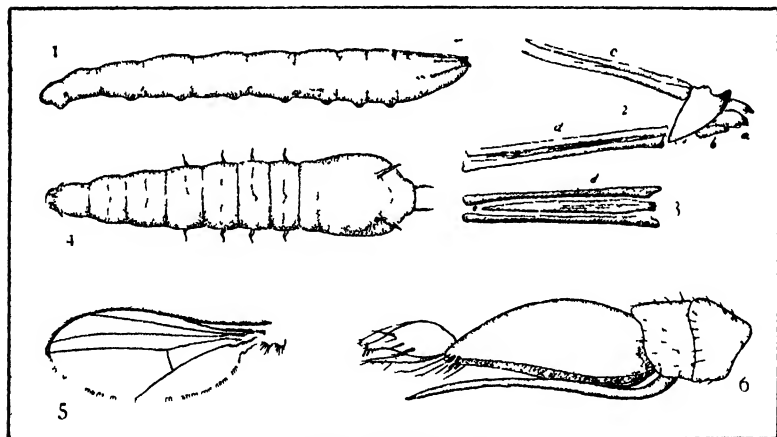


Fig. 1. *Thrypticus muhlenbergiae* sp. nov.

1, larva, x 10. 2, pupa, x 12. 3, pharyngeal skeleton, side view, x 60. 4, pharyngeal skeleton, ventral aspect, x 60. 5, wing of male, x 20. 6, hypopygium, lateral aspect, x 150.

of 3-toothed mandibles (a), each one with an elongate supporting segment (b) and a small basal piece, and projecting caudad are six more elongate parts. Two of the dorsal pieces (c) are slender and rod-like, their caudal ends thin and wedge-shaped, between these is a thin, subtriangular piece; two of the ventral parts (d) are rod-shaped, slightly enlarged at each end, a little longer than the dorsal pieces; between these is a thin lanceolate piece (e).

Pupa (fig. 4). Length, 4 mm. Pale amber yellow in color. At the anterior end are two prominent cephalad projecting setæ; the elongate lanceolate thoracic respiratory organs are yellow. Seven segments may be distinctly seen in the abdomen, of which the first four are each provided with a curved pointed appendage, on each side ventrally; across the center of the dorsum of each of the first six abdominal segments is a transverse row of about 38 setulæ. The last segment is provided with four stout diverging spines.

Imago. Male and female. Length, 1.75 mm., without the hypopygium. Palpi pale yellow, face and front metallic blue, in some lights with a greenish tinge. Antennæ amber yellow, arista pubescent. Frontal setæ and those of thorax and abdomen pale yellow. Eyes sparsely pubescent, cilia of inferior orbit pale. Mesonotum and abdomen bright metallic green with bluish reflections, the former slightly pruinose, the latter with yellow hairs; scutellum metallic blue; prescutellar depression shallow; pleura metallic green, darker toward the base of the wings. Tegulæ pale yellow with pale hairs. Hypopygium (fig. 6) of the male fuscous, the appendages yellow; the basal sclerite which forms the capsule, elongate oval, the lamellæ pear-shaped with several conspicuous, pale, setæ. Ovipositor of the female ferruginous. Legs and coxæ pale yellow. Halteres yellowish. Wings hyaline with dusky yellow veins, venation as figured (fig. 5).

This species is distinguished from *T. willistoni*, by the structure of the hypopygium. Perhaps the yellow antennæ and the wholly yellow coxæ may also be of specific importance.

SOME ACALYPTRATE MUSCIDÆ¹

BY A. L. MELANDER

By an interesting coincidence Mr. J. R. Malloch, then of the United States National Museum, and I made an independent study of the small flies grouped about the Agromyzidæ. Mr. Malloch's paper on the genus *Agromyza* is to appear in the September issue of the Annals of the Entomological Society of America, while his discussion of the other genera is to come out in the Proceedings of the National Museum. The first installment of my paper was printed in the September issue of the Journal of the New York Entomological Society, which was received at the Bussey Institution, through the mails, on September 8. The remainder of this article, dealing with the Geomyzinæ is to appear in the December issue of that publication.

The following notes were made on a recent visit to the National Museum and to the Philadelphia Academy of Science, and are

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No 73.

given as a supplement to my paper. While in Philadelphia I saw the proof sheets of Mr. Malloch's work, and while in Washington I examined his types.

1. *Scutops* Coquillett is not a Geomyzine. The post-vertical bristles are strongly divergent; the costa is nowhere fractured; the palpi are broadly spatulate; the first vein ends at the middle of the wing and the auxiliary vein, although rudimentary, is separated from the first vein, abruptly turning forward so as to terminate near the middle of the costal cell. In addition, the lack of oral vibrissæ, the presence of the clypeus, the single pair of reclinate fronto-orbital bristles, the stiff bristles of the front femora, the absence of preapical tibial bristles; and the shortened anal vein, support its relationships with the Lonchæinæ. The center of the face is broad and flat, obliterating the facial orbits below the antennæ. The face continues on the sides so as to line the mouth-opening; the cheeks thus consisting of the face, genæ and buccæ.

2. *Pseudiasata* Coquillett belongs with the Drosophilinæ. It possesses the following characters which are at variance with typical Geomyzinæ. The costa is fractured both at the humeral crossvein and at the end of the auxiliary vein, where there is a pronounced costal spine; the discal cell is confluent with the second basal; the single frontal bristle is proclinate; there are no mesopleural bristles; and the antennæ are spaced apart.

Mr. Coquillett was apt to over-stress some certain character, such as the vestiture of the arista, and as he relied much on his analytical keys, the microscopic pubescence of the arista of *Pseudiasata* led the genus to the Geomyzinæ. A similar instance occurred with *Sinophthalmus*, which presents more Drosophiline characters than it does Geomyzine. *Pseudiasata* has the anal cell present; the calypteres ciliate; the post-vertical bristles convergent; the oral vibrissæ present; the clypeus visible and moderately developed; the cheeks consisting of the genæ, buccæ and the sides of the face; the center of the face broad and flat; the front pubescent; and the propleural bristle lacking.

3. *Spilochroa punctipennis*, sp. nov.

Male. Length 2.5 mm. Cinereous, black; body not spotted. Cheeks, face and frontal orbits white-pollinose. Antennæ brown, the third joint blackish

except near the arista; arista with very short and close pubescence. Proboscis blackish, palpi whitish. Chaetotaxy as in *ornata*, the bristles long and strong: two fronto-orbitals; ocellars almost reaching the root of the antennæ; postverticals moderately long and cruciate; oral margin of the narrow cheeks with a row of five hairs, with a strong vibrissa and with a strong bristle in back; five dorso-centrals, four rows of acrostichals with about a dozen setulæ in each; one humeral; two notopleural; three supra-alar; four scutellar; one mesopleural and two sternopleural, as well as a few mesopleural and sternopleural setulæ. Abdomen setulose as in *ornata*, and with an indication of a brownish median stripe. Halteres and calypteres white, the latter with a weak white fringe. Posterior legs yellowish, front coxæ dull whitish, remainder of the front legs blackish. Wings mostly hyaline, but marked with about two dozen pale brown spots, the largest of which occur at the end of the first vein, in the tip of the marginal cell and on the posterior cross-vein. The spots are aggregated in the same general pattern as in *ornata*, but are not nearly so confluent as in that species.

The type, collected by Professor T. D. A. Cockerell at Pecos, New Mexico, July 26, is in the National Museum. Two paratypes were taken by H. S. Barber at Las Vegas Hot Springs, New Mexico, August 11 and 18.

4. *Trixoscelis fumipennis*, sp. nov.

Male. Length 2.5 mm. Very close to the European *T. marginella* Fallen, but differs in that the paler portion of the first and second posterior cells is not oval in outline.

Head and thorax, largely brownish-gray pollinose; front except the orbits and the rounded ocellar triangle testaceous; orbits at the antennæ reddish; face and cheeks white-sericeous; cheeks two-thirds the eye-height; antennæ reddish, the third joint largely dusky above; arista black, its pubescence microscopic; palpi yellow, proboscis reddish. Ocellar bristles reaching to the base of the antennæ. Thorax with a median brown stripe and with less evident brown vittæ bearing the dorso-central bristles; humeri and pleuræ reddish, becoming paler below; center of the scutellum a trifle darker than the sides; abdomen shining black. Coxæ, front tibiæ and posterior legs testaceous; front femora and tarsi blackish. Halteres and calypteres white. Wings largely darkly infumated, but the base, including the auxiliary cell, a narrow streak in the submarginal cell above the anterior cross-vein, the anterior portion of the discal cell, a middle stripe in the first posterior cell extending to the wing-tip, the greater part of the second posterior cell, and the anal angle, nearly hyaline; costal spines black; anterior cross-vein slightly beyond the middle of the discal cell; sections of the fourth vein proportioned three to four, of the fifth vein six to one; posterior cross-vein slightly longer than the outer section of the fifth vein.

Five specimens: Aweme, Manitoba, N. Criddle, collector, June 12, 1911. The type is in the collection of the Philadelphia Academy of Science, number 6018. Paratypes are in the collections of Mr. Criddle and myself.

Malloch¹ has described the Arizona specimens of *costalis* Coquillett as *claripennis*. This is the species I have designated as *frontalis* Fallen, which is common throughout the Pacific states. Hendel's *Trixoscelis prima* is the same as *Parodinia cinerea* Coquillett.

5. *Hemeromyia* was described by Coquillett as near *Agromyza*. It proves to be the same as the Milichiine genus I described as *Paramadiza*. Malloch's species *Hemeromyia nitens* is the same as my *washingtona*. Curiously enough the name *Paramadiza* was selected also by Malloch, as a new generic name for *Madiza halteralis* Coquillett. As the name *Madiza* is now used for the Chloropine genus *Siphonella* Macquart, the species *halteralis* is without a generic name. (See Malloch, *Canad. Entom.*, xlv., p. 177. June, 1913.) I would therefore suggest the appropriate name *Mallochiella* for this insect and for its European congeners. The identity of the *Paramadizas* may now thus be tabulated.

MALLOCHIELLA nomen novum.

halteralis Coquillett

Desmometopa (Coquillett)

Madiza (Hendel, Melander)

Paramadiza Malloch

HEMEROMYIA Coquillett.

obscura Coquillett

washingtona Melander

Paramadiza Melander

Syn: *Hemeromyia nitens* Malloch



Fig. 1. *Mutilopectera apicalis* Coq., wing.

6. *Mutilopectera apicalis* Coquillett. This is a curious fly, whose body characters are evidently Geomyzine. The entire posterior portion of the wing is aborted as shown in the sketch.

September 19, 1913.

¹The Genus *Parodinia* Coq. (Geomyzidae). Malloch, J. R. Ent. New, xxiv. 274-276 (June, 1913).

MEROPE TUBER IN MASSACHUSETTS.

While collecting at Chester, Mass., July 25, 1913, I found a specimen of this interesting Mecopteron. The specimen was under a board on the dam of the little reservoir on Austin's Brook, and had only recently emerged. Mr. H. S. Barber in 1904 (Proc. Wash. Ent. Soc., VI, 50) gave sixteen records for this species. Another specimen was recorded by the writer in 1904 (Psyche, XI, 38). In the collection at the Bussey Institution is a specimen from Sullivan Co., N. Y., collected in August, 1905.

C. W. JOHNSON.

MANTISPA INTERRUPTA SAY IN NEW ENGLAND.

A specimen of this rare Neuropteron was captured by Mr. Edwin R. Jump, at Lake Boone, Stowe, Mass., July 13, 1913. It is apparently the first record for this species in New England. Described from Philadelphia in 1824, it was later recorded from Virginia by Uhler. It is recorded in Smith's Insects of New Jersey, 1909, from Lakehurst, July 4-30 and Lahaway in June. A specimen of *Mantispa brunnea* Say taken at Walpole, Mass., is also in the collection of the Boston Society of Natural History.

C. W. JOHNSON.

A QUESTION OF AUTHORSHIP.

Under the title "*Limosina mirabilis* Collin, a species of Borboridæ new to the United States," a short note appeared in Psyche, vol. 19, p. 199, under the signature of Malloch and Knab. The undersigned hereby declares that he had no share in the writing of this paper, knows nothing of the subject, and that his name was subjoined, not only against his wish, but in spite of his repeated objections made to Malloch. This does not affect the status of two other papers published by the above named authors,¹ as the undersigned has had a sufficient share in the work connected therewith. These two last mentioned papers are the only ones in which the authors have collaborated.

FREDERICK KNAB.

¹ A borborid from an epiphytic bromeliad (Ent. News, vol. 23, p. 413-415, 1912); New Australian Diptera from ants' nests (Trans. Roy. Soc. S. Austral., vol. 36, p. 233-237, 1912.)

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Will name and return species in certain families of Coleoptera. Buprestidæ especially desired.—C. A. Frost, 26 Pond Street, South Framingham, Mass.

Wanted. Insects from ant-nests, with specimens of the ants, from any part of the world. Will give Coleoptera, Diptera and Hymenoptera from the Western United States.—W. M. Mann, Bussey Institution, Forest Hills, Mass.

Will exchange for Geometridæ from any section of North America, or identify material for privilege of retaining examples.—L. W. Swett, 501 Washington Street, Room 44, Boston, Mass.

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PSYCHE

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DECEMBER, 1913.

No. 6

THE DRAGON-FLY GENUS AGRION (*CALEPTERYX*) IN COLORADO.

BY T. D. A. COCKERELL,
Boulder, Col.

The beautiful genus *Calepteryx*, or as it seems we must now call it, *Agrion*, has a curious distribution in North America. Represented by several species in the eastern states, both north and south, it disappears westward of Iowa, to reappear, so far as the records have shown, only in the state of Washington, where *A. æquabile* subspecies *yakima* (Hagen) occurs on the Yakima River. However, on September 30, 1907, Mr. G. Hite took a male at Overland Lake, in the Canadian Zone of Boulder County, Col. This has remained unrecorded, because I repeatedly tried to identify it with one or other of the described forms, always without success. I did not like to propose it as new without seeing a good series of the genus, but now, after comparing it with the materials in the United States National Museum, I can only conclude that it represents a valid new race, as might have been expected.

Agrion æquabile coloradicum Nov.

Male. Structure and colors in the main as in *A. æquabile*; abdomen above rich purple, decidedly bluer than normal *æquabile*; structural characters of abdomen (both the apical and subbasal inferior structures carefully compared) not quite as in the *æquabile* compared, but probably not affording anything specific; anterior wing 29.5 mm. long, of which the apical 8 mm. is black; posterior wing 28.5 mm. long, of which the apical 10 mm. is black; in each case the black is quite intense, and has a practically straight inner margin, forming an angle with costa a little greater than a right angle; 24 antenodal cross-nervures in anterior wing, 22-24 in hind wing; costa blue.

As might perhaps have been expected, this appears to be nearest to the subspecies, *yakima*, which agrees in having the inner side of the apical black of the wings practically straight; in this character

both resemble the otherwise quite distinct *A. dimidiatum apicale*. In *yakima*, however, the apical third of the anterior wings is black.

True *A. æquabile*, of which I examined a very long series, is readily separated by the apical black of the wings, which is conspicuously less intense, having its inner side less well defined, and projecting toward the base of the wing in the middle, the shape of the inner margin being roughly that of a broad V. The *hudsonicum* form, which seems weakly characterised, goes with *æquabile*.

Possibly *A. yakima* should be considered a valid species, and *coloradicum* a subspecies of it.

The type of *coloradicum* has been placed in the National Museum.

DIDACTYLOMYIA CAPITATA SP. NOV.

By E. P. FELT,
Albany, N. Y.

The peculiar male described below was collected by Mr. Owen Bryant in August, 1907, either at North Adams, Mass., or on Greylock Mountain. It is closely allied to *D. longimana* from which it is most easily separated by its slightly smaller size, the capitate terminal clasp segment and the relatively longer harpes.

Didactylomyia capitata sp. nov.

Male. Length 1.25 mm. Antennæ probably a little longer than the body, sparsely haired, the stems white, the basal enlargement dark brown; probably fourteen or sixteen segments, the fifth with a stem one-fourth longer than the cylindric basal enlargement, which latter has a length two and one-half times its diameter. Palpi; the first segment irregular, with a length about twice its diameter, the second lanceolate, with a length nearly four times its diameter, the third a little shorter and more slender than the second, the fourth about as long as the third, somewhat dilated. Mesonotum, scutellum and postscutellum mostly reddish brown, the scutellum slightly yellowish apically. Abdomen yellowish, reddish basally. Halteres and legs pale yellowish white. Genitalia; basal and terminal clasp segments both greatly produced, the latter decidedly capitate apically; dorsal plate short, broad, deeply and narrowly incised, the sparse setose lobes narrowly rounded; ventral plate short, broad, broadly and roundly emarginate. Harpes, basal portion broad, obliquely truncate, the inner angles produced as a somewhat irregular, capitate process as long as the basal portion and extending to the tip of the style, which latter is stout, tapering and narrowly rounded. Type Cécid. 1439.

THE ALIMENTARY CANAL OF FLATA AND OTHER HOMOPTERA.

BY J. C. KERSHAW,
Trinidad, B. W. I.

In many of the Delphacidæ and Fulgoridæ there is a large food-reservoir or crop whose anterior end penetrates the thorax and often enters the head—in *Pyrops* and *Dictyophorodelphax* reaching to the tip of the greatly produced epicranium. In the present subject, *Siphanta acuta* Walker, a Flatid or Pœcillopterid the reservoir is very large and, from its junction with the œsophagus just within the abdomen, extends anteriorly above the œsophagus through the thorax and practically fills the epicranium above the brain. It also extends posteriorly—beneath the heart and above the rest of the internal organs—almost to the tip of the abdomen; when inflated it also spreads out laterally over the other organs, and expands into every available space in the body-cavity, and is then very irregular in contour, becoming much more shapely when contracted or when dissected out of the insect.

In the thoracic portion the reservoir possesses four rather large but often irregularly shaped latero-ventral cæca or pouches (fig. 3, ca), two on either side, which sometimes extend downwards into the coxæ in a manner analogous to the mesenteric cæca of spiders. Anterior to these cæca are two much smaller latero-ventral cæca, one on either side; to the end of each cæcum a slender and rather long muscle is attached, the other end of the muscle attaching to the lateral posterior margin of either side of the prothorax. Occasionally the other cæca also possess slender muscles which attach them to the body-walls, thus serving to anchor the reservoir, but still allowing it plenty of freedom to expand and contract. The reservoir, although tracheæ ramify over it as they do over the rest of the mesenteron, is not moored by them to the body-walls. The tracheæ are not shown in the figures.

This reservoir is an extension of the mesenteron and not of the œsophagus, as appears by the character of its epithelium and its development in the embryo. In the latter (figs. 1 and 2)

the mesenteron, including the reservoir, is completed very shortly—one or two days—before the nymph hatches out; but the œsophagus and salivary glands, the rectum and malpighian tubes are complete several days earlier. The chitinous intima of the œsophagus and rectum is already secreted, though as yet in a plastic condition, at the stage shown in figure 2. The dorsal wall of the midgut and the anterior part of the reservoir are the last portions of the mesenteron to close up and complete. The midgut appears to proliferate from a small mass of cells at the inner ends of the œsophagus and rectum respectively: it appears, therefore, to be of ectodermal origin. The basement-membrane of the mesenteric epithelium is more or less chitinous and apparently secreted by the epithelium itself. The peritoneal membrane is largely developed in this insect (and many other Homoptera, and more or less envelops the whole alimentary canal and its appendages, and appears to be only deficient over the anterior part of the œsophagus, a small posterior portion of the rectum and the long loop (fig. 3, part outside line indicating peritoneal membrane) of the midgut; but it is probable that it is merely exceedingly delicate over this area, and, therefore, practically invisible. In figures 3 and 4, however, the peritoneal membrane is only shown over those parts where it is a really thick tissue, and thus in figure 4a it appears to leave the œsophagus anteriorly and continue only on the reservoir. The posterior part of the œsophagus, the anterior part of the rectum, part of the midgut and reservoir and the proximal portions of the malpighian tubes lie alongside one another in close contact, and are also twisted around each other. The whole tangle is closely invested by the peritoneal membrane; in figure 3 the parts are not shown twisted, in order to keep the figure clear. There is a constriction (fig. 4 frv.) around the reservoir, just in front of the œsophageal valve, provided with extra annular muscles; this occasionally shows as a slight invagination (similar to the œsophageal valve), but in any case it forms a valve for the reservoir, to admit or prevent the passage of food therein.

Berlese supposes (in apparently similar cases of Coccidæ) that by this unusual arrangement of the alimentary canal and its appendages, osmosis of the innutritious watery part of the food and the excess of sugar therein, may take place through the various

parts in contact with the delicate walls of the organs directly into the rectum or posterior part of the gut; thus avoiding passage through the long and tortuous midgut, but leaving the more nourishing matters to take the ordinary course through the whole canal. This would, in fact, be supplementing the action of the peritrophic membrane, whose chief function seems to be that of separating the useless from the useful portions of the food—or rather, retaining the indigestible matter within the membrane till its evacuation from the anus. Certainly the twisted loops of the gut are in intimate contact and their tissues even in part grown together or fused: from which cause this part of the gut is difficult to disentangle without injury. Feeding the insects on colored liquids tends to confirm this theory, since the contents of the long loop of the midgut are very faintly if at all tinted, whilst the rectum is heavily colored.

The epithelium of the reservoir (fig. 4) is formed chiefly by low but very irregular cells, which appear to be in a constant state of degeneration and renewal. In sections from a long series of reservoirs of *Siphanta* during almost every month of the year, there was not one with a moderately perfect epithelium; but one reservoir of *Perkinsiella* was once obtained in very good (apparently resting) condition, out of a long series. The young cells have a single nucleus, but the older ones are mostly bi-nucleated, though very often a cell will have but one enormous nucleus. The epithelium of the cæca is similar but usually in rather more perfect condition, and seems to be constantly renewed by young cells at the bottom or end of the cæca. The cells of the reservoir are in one place or another apparently always secreting; after a time the nuclei become much larger and irregular in shape and the cells become detached from the basement-membrane, or are thrust from it by the new cells. When several contiguous cells become detached they seem to carry with them part of the inter-cellular cement or membrane, which shows in sections as an irregular reticulum; or it may be the cell-walls persisting longer than the contents. The cast-off cells generally assume a more or less globular form (probably on escaping from the lateral pressure of adjoining cells of the epithelium) and rapidly disintegrate, the nuclei becoming less and less distinct; finally the cells appear to become a granular and somewhat viscid fluid (probably the granules rep-

resent enzymes) and afterwards the viscid matter seems to take part in the formation of the so-called peritrophic membrane. The young nuclei take hæmatoxylin strongly; the secreting upper portion of the cells and the cast-off disintegrating cells tend to stain lightly with acid fuchsin or congo red or picric acid; or else they refuse to stain at all.

The peritrophic membrane seems to be secreted also by the epithelium all along the midgut, although the nuclei of the cells of the œsophageal valve appear different from those of adjoining cells, as if they might be special cells secreting the whole membrane; as concluded by Miall and Hammond in the case of *Chironomus*.¹ But this does not seem probable with regard to *Siphanta*, because certain cells along the whole midgut epithelium can be plainly observed secreting, some of the globules of secretion adhering to and spreading over the outermost layer of the peritrophic membrane. This latter extends from the anterior end of the reservoir through the whole canal to the anus, where it appears to pass out with the rest of the excrement, in a granular or disintegrated condition. The peritrophic membrane is seen in transverse sections (fig. 4B, pm) to be composed very often along some parts of its length of more than one membrane or parts of several non-synchronous secretions, one within another and more or less concentric. It is not very evident how the peritrophic membrane itself can protect the mesenteric epithelium—as it is said to do—by keeping particles of food etc. from contact therewith, since the membrane is very irregular in contour and, when shrunken, comparatively rough, with occasional parts of cell-walls and other matters in its wall not completely digested or dissolved; it is also more or less chitinous. It would appear, rather, that the epithelium of the mesenteron is protected from both food-particles and peritrophic membrane by the layer of viscid fluid mentioned above, which is between the epithelium and the membrane, and which afterwards—in part at least—seems to compose the said membrane. This fluid would tend to keep the latter with its contents fairly in the center of the alimentary canal, even when rounding the numerous sharp bends of the gut. But it may be that only the older internal membranes

¹ The Harlequin fly, Miall and Hammond, 1900.

move endways or disintegrate, passing through the recently-secreted membranes to the rectum, the recent membranes merely being pushed inwards (towards the centre of the canal) by yet more recent membranes.

The reservoir epithelium, tested by litmus in many specimens, invariably gave a very decidedly acid reaction; but the juices of leaves and young stems of *Eucalyptus robusta*, on which the Flatids were feeding, is very acid and immediately reddens blue litmus paper. Probably, therefore, the acidity of the reservoir is due to the food. From the results of feeding several *Siphanta* on rods of pith soaking in red or acid azolitmin, the secretions of the whole alimentary canal appear to be very slightly alkaline, since the contents tended to become more bluish: the epithelium itself does not stain, or not perceptibly. In one specimen fed as above for three days, the contents of the whole gut were faintly red, except the rectum which was strongly blue, with no trace of purple. The chief function of the reservoir seems, on account of its secretive activity, to be digestive. It may also in some way aid in getting rid of the waxy matters which are so abundantly excreted by these insects. It also collects a quantity of air, separated from the food imbibed; there is always some air, often (especially just after the moult to adult) a very large amount. In the many specimens examined there was always some liquid in the reservoir, and sometimes it was nearly full; the contents were well shown by feeding the insects on *Sonchus* plants growing in water deeply tinged with fuchsin. The liquid food in the alimentary canal always appears to contain a percentage of waxy matter, as does the excrement, although the greater part of the wax in the latter is due to wax-dust from the anal segment wax-glands, which forms a powdery film over the globule of excrement immediately on its evacuation from the anus.

Probably some sugar, and fat in the form of oil, is imbibed with the food and directly assimilated; passing outwards by osmosis through the peritrophic membrane and being absorbed by the cells of the posterior part of the alimentary canal. The digestive matters of the enzymes could also pass inwards through the membrane and convert starch into sugar and peptonise proteids; the products of digestion could then also pass outwards through the membrane, ready for absorption by the cells of the epithelium.

It would seem possible that the diastase of the plant may be imbibed with the rest of the juices, and assist the action of the digestive secretions of the insect. It does not seem probable that the reservoir is a mere store-vessel only, to be drawn upon intermittently. It may perhaps be so spacious in order to give increased area for the digestion and absorption of a comparatively innutritious food,¹ so that it may be rapidly passed on and fresh supplies taken in. On the other hand many Homoptera feeding in like manner on the same plants have no reservoir, though perhaps in these the area of the gut is increased in other directions.

In the nymph just hatched the reservoir does not always enter the head, but soon afterwards it does so, and is completely formed at the time the nymph hatches out. In the head the reservoir lies practically free, but is slightly attached by connective tissue to the front of the head-capsule.

In the nymphs, at each successive moult, there is an almost total and sudden degeneration and disappearance of the epithelium of the alimentary canal, very little remaining but the musculature and peritoneal membrane. The epithelium is then very quickly regenerated.

The muscles of the oesophagus consist of two layers of stout annular fibres crossing each other almost at a right angle (fig. 4). The nuclei of the oesophageal valve are larger than those of the rest of the oesophagus, and rounder than those of the mesenteric epithelium. They probably secrete more actively than the rest of the oesophageal cells, since the six chitinous folds of the intima are much thicker at the valve, forming six cushions or pads at its summit. There seem to be no special glandular cells in the oesophagus, but the salivary-glands and reservoirs in this insect are very voluminous. They give a decidedly alkaline reaction when tested with litmus. Their secretion would probably convert

¹ That it is a somewhat innutritious food compared with that of carnivorous insects may be inferred from the time the insect spends in feeding, and the large amount of excrement continually voided, compared with a carnivorous insect. And besides the faeces must be included as excrement the large quantity of waxy substances excreted from various parts of the body. For although the wax of Homoptera may have become useful in certain ways, such as a covering for their eggs when laid, etc., yet originally it can have had no such use, but was a waste product to be gotten rid of. Yet the phloem of plants contains in the sieve-tubes much proteid matter in the form of a nitrogenous slime, which must be sucked up by the insect along with the rest of its liquid food. Perhaps the Homoptera require such large quantities of food because it is not in a very concentrated form.

much of the starch into sugar before its entrance to the mesenteron, since the secretion is poured out on the hypopharynx, where it mingles with the food, and has then to traverse the pharynx and long œsophagus before entering the mesenteron. The œsophageal valve does not usually lie exactly beneath the reservoir as shown for the sake of clearness in figure 3, but both œsophagus and reservoir twist slightly near the valve, *i. e.*, as soon as they leave the thorax with its mass of muscles and enter the abdomen and have more space, so that the valve and reservoir generally lie somewhat on the right-hand side.

The mesenteric musculature (fig. 4) consists of an inner transverse and an outer longitudinal layer of rather slender fibres. In the rectum this disposition of the muscles is reversed.

The four malpighian tubes (fig. 3) for the greater part of their length are plain, rather large diameter tubes, but the short distal portion is of smaller diameter and lobulate, the cells of one side alternating with those of the other. The nuclei of the main portion are more or less globular, those of the distal portion long or oval, but these latter sometimes become very irregular and much branched, probably when actively secreting. This distal part seems to secrete from the blood and excrete into the lumen of the tube a resinous-waxy substance, allied to that of the cuticular wax-glands; it was obtained by boiling several of the distal ends in ether in a small test-tube. The whole tube is at times of a hyaline appearance, of smaller diameter and in color pale yellowish. Generally the main portion is opaque white and often greatly distended for its whole length with urates, calcium oxalate and other waste products, whilst these are not found in the distal portion, which always remains hyaline. The proximal part of the tube, just at its entrance to the gut, somewhat resembles the distal part. The tubes are covered externally by peritoneal membrane, with a few elastic fibres and tracheae; they have a chitinous basement-membrane, apparently secreted by the epithelium which rests upon it; the lumen of the tube is lined by a thick chitinous secretion of the epithelial cells, and has a distinctly striated appearance. When treated with potash and examined under a high power, the intima is seen to be creased or furrowed longitudinally, so that it has the appearance of being formed of six strands fused together spirally—much like a piece of rope.

At times the epithelium also appears transversely striated, *i. e.*, at right angles to the length of the tube; especially in sections or when teased fresh in potash. When the malpighian tubes are swollen with urates, etc., if placed in weak acetic acid the entire contents—urates, intima and epithelium—are quickly evacuated, and the basement and peritoneal-membranes left as an empty shell.

The cells of the epithelium of the tubes seem to disintegrate locally and be replaced by new cells, and frequently (when fully loaded and distended with urates, etc.) the epithelium of long portions of the tubes appears to disintegrate and to fall into the lumen, dissolve and be discharged into the rectum, new cells taking their place. This seems to recur several times during the life of the insect. At all times some of the cells can be seen in sections secreting large globules of matter into the lumen. The distal ends stain much more heavily than the rest of the tube.

The contents of the malpighian tubes give a decided reaction to the murexide test; when the tubes are white and swollen they contain a very large quantity of urates of soda and ammonia in minute roundish granules, appearing to the unaided eye as a whitish sediment; under the microscope they appear white by reflected and pale yellow-brown by transmitted light. By treatment with dilute acetic acid (2 per cent.) very many large colorless crystals and bundles of crystals of uric acid¹ are usually to be seen, which resist the action of hydrochloric acid. Calcium oxalate crystals also occur in numbers, and do not dissolve in water nor in acetic acid, but are entirely dissolved by hydrochloric acid. They may be distinguished microscopically by their form (squarish, with two diagonal lines from corner to corner), and chemically by the decoloring of permanganate of potash added to a solution of the calcium oxalate crystals in sulphuric or hypochloric acid.

Sometimes, on leaving the tubes in water for about twenty-four hours, they are surrounded by a layer of mucilaginous matter which appears to have exuded from the whole of the tubes except the distal ends. Occasionally the tubes are very irregularly swollen here and there into lumps, and are then usually of a bluish hyaline appearance. In this state, which is not common, they

¹ And also what look very like hippuric acid crystals.

seem to contain much waxy matter, and comparatively few urates. But the malpighian tubes require much more study in long series and at all periods from nymph, to adult.

Whilst examining many adults of *Siphanta acuta*, one specimen was found which had one tube completely and perfectly forked distally, just as in *Perkinsiella saccharicida*.

The malpighian tubes of the Homoptera mentioned in this paper are not intricately mixed up with the fat-body and other internal organs, nor so much tied and entangled with tracheæ as in most insects. The distal ends nearly always lie very near the extremity of the abdomen. Occasionally the tubes are connected by the tissue of their distal ends, generally in pairs, but their lumina do not communicate.

The tips of the setæ of *Siphanta* do not appear to penetrate the xylem of vegetation, but it is difficult to kill a specimen so that the setæ are left in the foodplant. The sketch given (fig. 5) was made from a mealybug (*Icerya purchasi*). Several were feeding close together on a young stem of a leguminous tree, and a piece of this was suddenly plunged into benzene, which kills them quickly. Some of the sections made showed the setæ even more twisted than those in the sketch. When the tips of the setæ encounter any hard obstacle they glance aside till they meet another hard spot, again following the least resistance till they reach the layers of tissue next the cambium. Some of the mealybugs had penetrated the cambium, but none had entered (though one or two had touched) the xylem. This might be expected, since all the matters useful as food to the insect are contained in the tissues external to the xylem: the contents of the latter being mere water with mineral salts in solution.

The tissues of the *Eucalyptus* trees on which these Flatids were feeding contain a large quantity of oil and resinous-wax. Some of these substances must be imbibed by the insects, and a great deal of wax (more or less resinous) is excreted by them during their nymphal and adult life. This wax is largely secreted and excreted by anal wax-gland areas, but minute wax-glands are scattered over almost all parts of the insect, even on the head and wings. They are very numerous and rather large on the claval area of the tegmina of *Siphanta*, and they occur on the tip of the epicranium of *Pyrops*. The Membracidae also have small

wax-glands on the tegmina, and in the nymph they are numerous on the pronotal hood. They occur in most positions where "sensory-organs" also occur, and being also little crater-like processes on the cuticle may sometimes be mistaken for the latter organs.

A fairly large quantity of the wax excreted from the various cuticular glands was collected by boiling the cast skins of nymphs with ether in a Soxhlet extractor, and the following data therefrom were kindly given by Mr. S. S. Peck, chemist at this experiment station,² to whom also I am indebted for some tests of the contents of the malpighian tubes given above:

The wax is slightly soluble in alcohol and in ether, easily soluble in benzene. It separates in crystal form. Sp. gr. at 17° = .0972, at 90° = .0826. Melting-point 80°-83.5°.

¶ A quantity of leaves and bark from young stems of *Eucalyptus* was extracted with benzene in the cold, and the liquid then evaporated, when a fairly thick film of resinous-wax was left on the bottom and sides of the vessel. This residuum was green from contained chlorophyll. The wax appeared to be similar in part to that excreted by the malpighian tubes of the insect, and also by the cuticular wax-glands.

The total length of the adult alimentary canal from the beginning of the œsophagus to the anus is about 35 mm., when not unduly extended.

Siphanta acuta appears to live about two months as an adult. One individual fed well on a young growing *Eucalyptus* tree, and moulted to adult on April 28, dying on July 1. Another specimen was very near these dates, and both apparently died of old age, the bright coloring having become very dull, in some parts whitish, in others yellow-brown. The vivid yellow-green of young adults becomes a glaucous green in older individuals. Although in the early part of the year the eggs of this Flatid hatch in about twenty days, in the fall they hatch in about ten days.

The three tissues of the midgut—basement-membrane, epithelium and intima—seem homologous with the corresponding tissues of the stomodæum, proctodæum and body-walls. The basement-membrane of the epidermis is chitinous, and that of

² Hawaiian Sugar Planters' Experiment Station.

the midgut is also chitinous though very thin. Both epithelia are very similar and secrete a more or less chitinous material from the free ends of the cells, though the somewhat chitinous intima is modified from the highly chitinous secretion of the cuticle. Of the two mesodermic tissues the muscular layer invests the inner wall of the body-cavity and also what is really (if the whole gut is of ectodermic origin) the inner wall of the alimentary canal; the intima of the lumen being its outer or external wall; it also invests the appendages of the gut. The peritoneal layer forms in *Siphanta* an apparently complete investiture of the alimentary canal, though it is in some parts exceedingly thin and barely visible. In the embryo the peritoneal layer seems to originate in close connection with the pericardial and neural septa.

If the midgut is really of ectodermic origin, then that part of the secretion which eventually seems to produce the peritrophic membranes is probably a modification of the secretion which forms the chitinous cuticle. The membranes resist for some time the action of potash: however, the secretion which produces chitin is easily soluble in potash if it is acted upon soon after being secreted and before much exposure to the external air. The secretions of certain colleterial glands also are very soluble in potash when freshly secreted, but soon become almost insoluble, apparently from the action of the external air.

In the Cixiid genus *Oliarus*, at least in the Hawaiian species (fig. 6), the anterior part of the reservoir extends to the head but does not enter it: makes a sharp bend and returns through the thorax to near the abdomen, lying close alongside the posterior part. In the younger nymphal instars the reservoir is not so long, and has no bend and return portion, but this develops before the final moult to adult. The malpighian tubes are forked distally for a great length, the forked portion being lobulate, the rest smooth and of smaller diameter. They are generally of a pale brown.

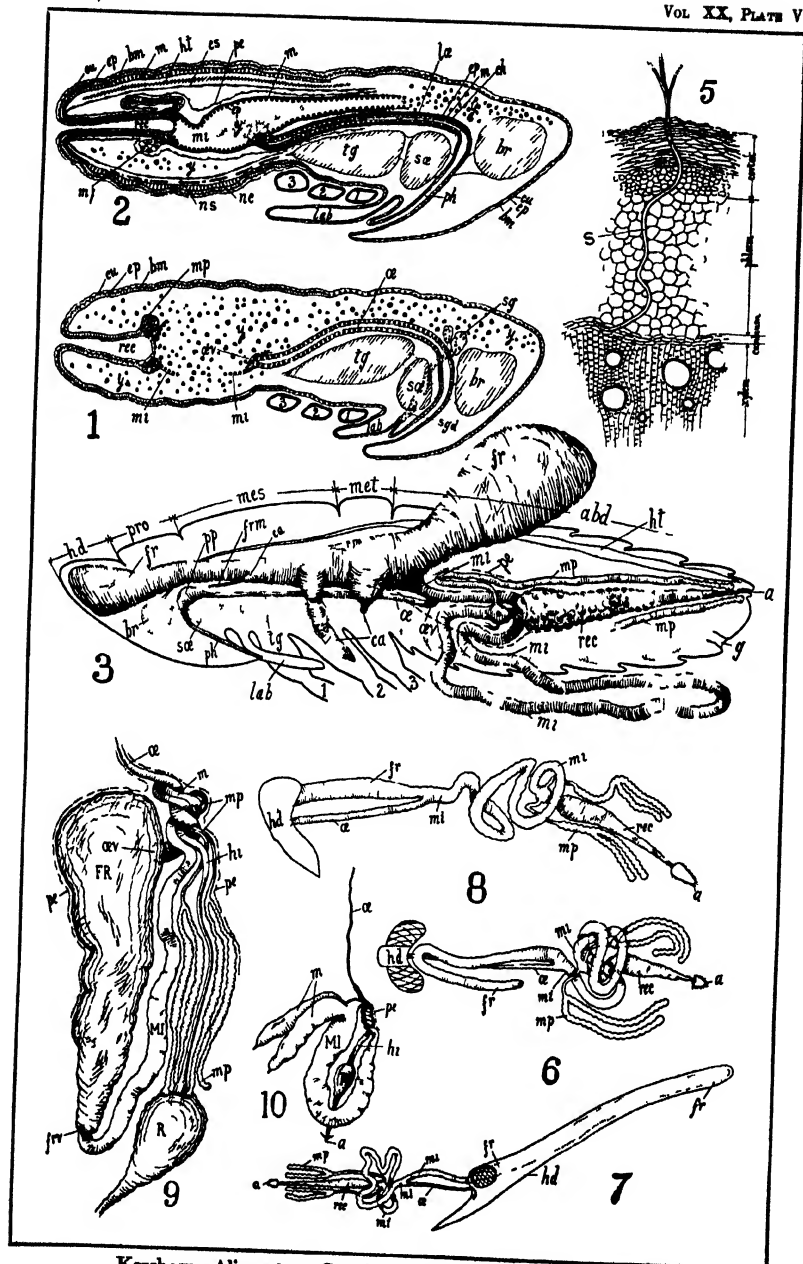
In *Dictyophorodelphax mirabilis* Swezey, an endemic Hawaiian Delphacid (fig. 7), the reservoir enters the headcapsule and continues to the tip of the greatly produced epicranium. The malpighian tubes are forked distally for a moderate length, the forked part being lobulate, the rest smooth. They are of a pale brown.

In *Perkinsiella saccharicida* Kirk., a Delphacid (fig. 8), the

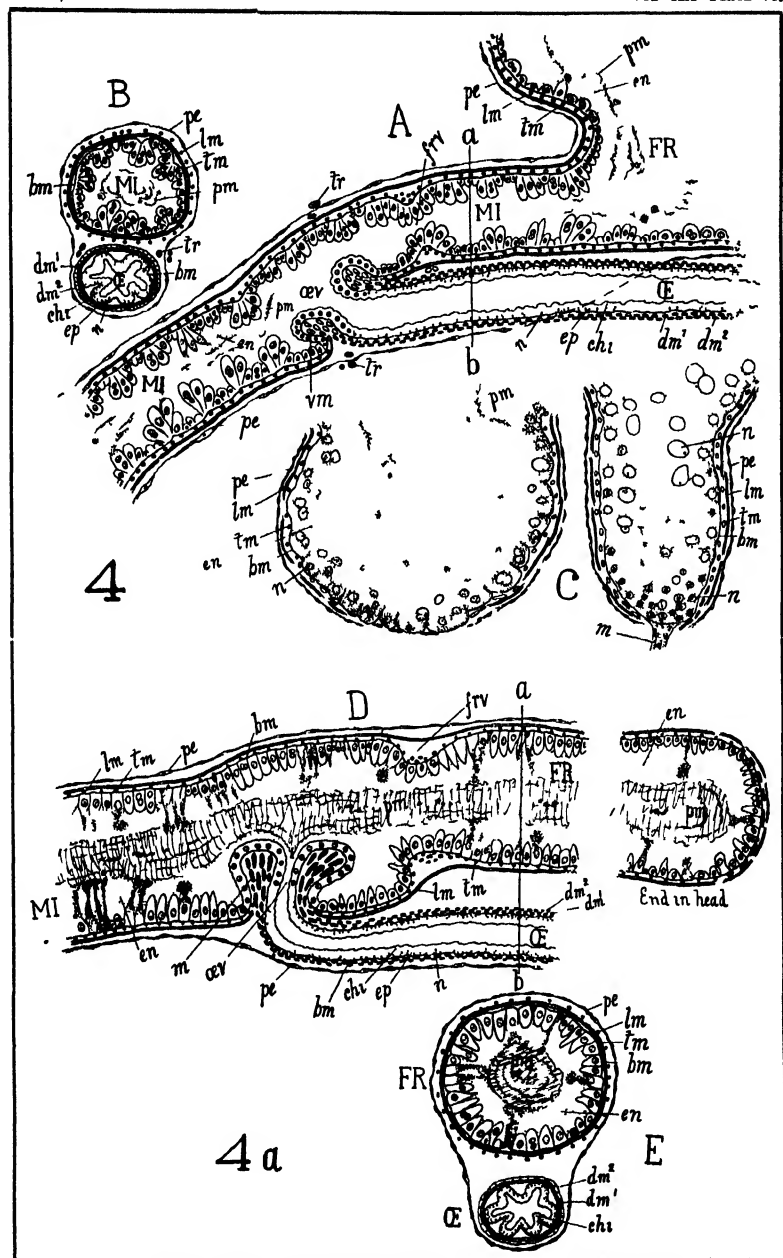
reservoir enters the head. The malpighian tubes are forked distally for a considerable length, the forked and about half the single portion being lobulate, the rest smooth. The color varies from pale pink to dark purple-red.

In the family Membracidae the alimentary canal (fig. 9) differs in arrangement from the foregoing insects. The anterior part of the reservoir only projects slightly into the thorax: posteriorly it extends to near the extremity of the abdomen as a sac of large diameter, though gradually narrowing to the reservoir-valve. The posterior part of the œsophagus, together with portions of the midgut and proximal parts of the malpighian tubes are wound or twisted together, so that it is very difficult to disentangle without injuring them, especially as their tissues where in contact coalesce, and the whole mass or knot is invested by peritoneal membrane. The malpighian tubes are forked, the fork extending to somewhat near their point of origin. They originate as two tubes, each of which afterwards forks and together form the usual four tubes. The proximal single portions are smooth, the rest lobulated. Often the mid-part of the tubes is much swollen for a considerable length by urates, etc., and this portion is then of an opaque white. Otherwise their color is pale brownish or yellowish. The distal ends generally abut on the rectum, into which they usually bulge somewhat. In other cases the distal ends are sometimes united in pairs, but their lumina do not communicate.

Of the family Aleyrodidae, *Aleyrodes, sonchi* Kotinsky, a native of the Hawaiian islands (fig. 10), has no reservoir. The œsophagus is very long and slender, and the posterior portion of it, together with the anterior part of the hind intestine are twisted around each other for some distance, and apparently enclosed with a peritrophic membrane. The malpighian tubes are two in number and very large; they appear to be always more or less clear or hyaline and colorless. Besides uric acid there appeared to be hippuric acid crystals in the tubes. The junction of the midgut and hind intestine (where the malpighian tubes originate) is right up at the anterior end of the abdomen, near the base of the œsophagus, when the gut lies in its natural position in the abdomen. The tegmina and wings of this insect are white from the wax excreted from the numberless tiny glands thereon.



Kershaw—Alimentary Canal of Flata and Other Homoptera.



Kershaw—Alimentary Canal of Flata and Other Homoptera

In conclusion, I am indebted to Dr. H. Lyon, the pathologist of this experiment station, for much information about the plants on which these insects feed, especially with regard to the nature of the vegetable juices which they imbibe.

EXPLANATION OF FIGURES.

1. Early embryo of *Siphanta acuta*. Fam. Flatidæ.

2. Later embryo of the same.

3. Alimentary canal of the same.

4. Details of the same.

A=longitudinal section of mesenteron and œsophagus.

B=transverse section of same, through line a—b

C=longitudinal sections of caeca of reservoir

4a:

D=longitudinal section of mesenteron and œsophagus of *Perkinsiella saccharicida*.

E=transverse section of same, through line a—b

5. Transverse section of young stem of plant, showing setæ of a mealybug amongst tissues.

6. Alimentary canal of *Oliarus* sp. Fam. Cixiidæ.

7. Alimentary canal of *Dictyophorodelphax mirabilis* Sw., Fam. Delphacidæ.

8. Alimentary canal of *Perkinsiella saccharicida* Kirk., Fam. Delphacidæ.

9. Alimentary canal of *Tricentrus albomaculatus* Dist., Fam. Membracidæ.

10. Alimentary canal of *Aleyrodes sonchi* Kot., Fam. Aleyrodidæ.

In all the figures of the alimentary canal the parts are more or less opened out, so as to show clearly.

LETTERING OF FIGURES.

a = anus.

abd = abdomen.

bm = basement-membrane.

br = brain.

ca = cæcum.

chi = chitinous intima.

cs = cardiac septum.

cu = cuticle.

dm¹ = inner diagonal muscles of œsophagus.

dm² = outer diagonal muscles of œsophagus.

en = viscid fluid between epithelium and peritrophic membrane, probably containing the enzymes; only shown in the figures in two or three places, to keep them clear; except in figure 4a.

ep = epithelium.

fr = food-reservoir.

frm = food-reservoir muscles.

frv = food-reservoir valve.

g = genital opening.

hd = head.

hi = hind intestine.

ht = heart.

lab = labium.

lm = longitudinal muscles.

lce = lumen of œsophagus.

m = muscles.

mes = mesothorax.

met = metathorax.

mi = mid-intestine (midgut, mesenteron).

mp = malpighian tubes.

n = nucleus.
 nc = nerve-cord.
 ns = neural septum.
 œ = œsophagus.
 œv = œsophageal valve.
 pe = peritoneal membrane.
 ph = pharynx.
 pm = peritrophic membrane.
 pp = pharyngeal pump.
 pro = prothorax.
 R, rec = rectum.

s = setæ.
 sg = salivary glands.
 sgd = salivary gland duct.
 scœ = subœsophageal ganglion.
 tg = thoracic ganglion.
 tm = transverse muscles.
 tr = trachea.
 vm = valve muscles.
 y = yolk.
 1, 2, 3 = coxæ.

ON THE EARLY STAGES OF SOME WESTERN CATOCALA SPECIES.

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It was our good fortune in the autumn of 1912 to obtain ova of several species of *Catocala* whose early stages had never been studied. Most of these we successfully bred through to the adult stage; colored figures of the larvæ have been made and will be published later in connection with Beutenmüller's Monograph of the Genus *Catocala*, which we have been asked by the trustees of the American Museum to revise and complete for publication; in the meantime we offer the following notes on the larval stages. The species in question may be roughly divided into two groups—the oak feeders, comprising *zoe*, *aholibah*, *ophelia*, *beutenmuelleri*, and *desdemona*, and the willow and poplar feeders consisting of *faustina*, *californica*, *irene*, *pura*, and the species going under the name of *aspasia* Strecker. These two groups may be readily separated in the first larval stage by the fact that the setæ arising from the primary tubercles are much longer in the oak feeders than in the willow and poplar feeders, giving the former under a lense quite a spiny appearance, whereas the latter appear almost smooth. Among themselves the larvæ of each group are very similar in the first stage; the oak feeders are of a bluish-gray color with more or less strongly developed deep brown lateral blotches on the first four abdominal segments, 5-6 brown lateral lines and at times a similar centro-dorsal line; the presence of this dorsal

line in Stage 1 separates *zoe* and *aholibah* from the other three species; these two may be distinguished from each other, apart from the ova, which are very dissimilar, by the fact that the brown lateral blotches in *aholibah* tend to form more or less evident transverse banding and the two spiracular lateral lines are more broken than in *zoe*; in later stages the two species diverge widely from each other. Of the other three *desdemona* is distinguished by possessing 6 lateral brown lines in Stage 1 instead of 5 as in *beutenmuelleri* and *ophelia*; of these latter two species *ophelia* shows two subdorsal lines in Stage I which are not developed in *beutenmuelleri* until Stage II. In the later stages of all these species the spaces between these brown lines gradually become paler than the ground color, forming stripes to which the lines act as a border, becoming more wavy in character and finally breaking up into a series of dots scarcely to be distinguished from the general surface of the body which is strongly sprinkled with similar dots; the dorsal stripe with its characteristic diamond-shaped enlargements on the abdominal segments appears usually in Stage II, either as pale irregular bordering to the centro-dorsal line, or failing this line as a pale stripe between the two subdorsal lines, in which case the centro-dorsal line makes its appearance later.

The willow and poplar feeders bear still more resemblance to each other than the oak group and are almost indistinguishable from one another in Stage I. All have a reddish-brown head and a pale greenish body shading into purplish or blackish laterally, this darker portion crossed by three pale rather waved lines; *aspasia* is the palest, and is almost entirely whitish-green with only faint traces of the lines; *californica* is the darkest, being laterally almost black in Stage II; the others are intermediate. The development of the maculation is the direct antithesis of that found in the oak-feeders; the stripes develop directly from the pale lines of Stage I, the darker bordering lines (the only ones visible in the 1st stage of the oak-feeders) appearing only in the 2nd or 3rd stages.

We append a more detailed description of the various stages:—

Catocala zoe Behr.

Orum. Large, echinus-shaped, liver-brown with irregular ring of yellow around widest part; strongly ribbed, about 16 ribs diverging from the micropylar area and branching into 2 or 3 almost immediately, these ribs crossed at right angles by

very fine ribbing; micropylar area a rosette of minute cells. Width, 1.5 mm. Height, .8 mm.

Stage I. Head flat, black; body blue-gray; a dark dorsal line; a lateral band paler than the ground color, bordered on each side by a fine dark line and containing a similar central line; two further dark subspiracular lines; on abdominal segments I-IV small round deep brown patches laterally; primary tubercles black, prominent especially those situated ventrad to the pale lateral stripe, each with a long black seta. Beneath pale gray with central dark blotches. Length, 6 mm. Width of head, .5 mm.

Stage II. Head whitish, strongly marbled with black, with two black lines in front, bending away from each other as they approach apex of cheeks, a central dark line in clypeus and a curved line around lateral portion of the cheeks; body gray with dark brown dorsal line irregularly bordered with whitish, this color tending to spread out into diamond-shaped patches towards rear of each segment and defined outwardly by a blackish line; lateral whitish band as before with dark borders and central line; below this a black line on a level with tubercle IV; a 5th subspiracular line bordered dorsally with whitish; dark blotches on abdominal segments 1-4 as in previous stage; tubercles large, black, increasing in size towards posterior end; prolegs with a strong black chitinous lateral plate. Beneath whitish with dark central blotches. Length, 12 mm.

Stage III. Head as in previous stage; on the body the light stripes of the previous stage have so broadened that the general ground color appears light gray slightly mottled with flesh color, the darker portion being confined to a subdorsal irregular band and a similar lateral band in the region of tubercle III; a light gray, very irregular dorsal band defined outwardly by black lines and broadening into diamond patches at the rear of each segment with a dark centro-dorsal line; the subdorsal dark areas are more or less shaded with gray anterior to tubercle II; lateral gray area and dark lines as before; ventrad to this is the lateral dark area on a level with tubercle IV, paler on thoracic segments, with mere traces of dark lateral patches of previous stages, bounded ventrally by dark line; the light area ventrad to this contains two dark lines, the lower forming the outer margin; dorsal tubercles conical, shaded black and white, especially large on 8th abdominal segment; a small transverse dark wart dorsally on 5th abdominal segment. Beneath whitish with black central patches. Length, 18 mm.

Stage IV. Head gray strongly striate with black; a black upright dash in central front portion of cheek and a broad curved lateral line of same color; body pale gray, marbled, rough and tubercular in appearance; markings essentially as in preceding stage; the pale gray dorsal stripe with diamond-shaped enlargements is usually quite prominent owing to its being bordered by a darker gray subdorsal stripe, deepest in color on the 1st, 2nd and 5th abdominal segments; dark supraspiracular stripe distinct, paler in anterior portion and on 4th abdominal segment; dorsal tubercles pale, ochreous, raised, with more or less of a transverse ridge between the two tubercles II, especially marked on 1st, 2nd, 5th and 8th abdominal segments; on 5th abdominal segment a small dark transverse dorsal wart, shaded posteriorly with blackish; tubercle II on 8th abdominal segment large and conical; tubercle IV situated on a rather raised wart just behind spiracle; below

this a dark line in a paler field is distinguishable. Beneath pinkish white with the usual dark blotches. Length, 30 mm.

Stage V. Head pale ochreous, the upper portion of the lobes tinged with orange, marbled with dark purple-gray with black lateral line descending as far as the ocelli; slight central black line to clypeus. Body very warty both dorsally and laterally, with deep lateral indentations above and below the spiracular area, pale gray, marbled with olive brown, maculation quite similar to that of the preceding stage; dorsal stripe pale gray, irregular, broadening at rear of each segment into diamond-patches which are tinged with ochreous on abdominal segments 1-4; subdorsal stripe dark brownish, broad, waved, prominent behind tubercle II on abdominal segments 1-3, 5 and 8, paler and more diffuse on the other segments; dark spiracular stripe, paler on the thoracic segments, abdominal segment 4, the anterior portion of 5 and posterior portion of 6, abdominal segments more or less humped dorsally between tubercles II, most so on 5 and 8; tubercles situated on a raised hump, tinged with ochreous. Lateral filaments whitish. Beneath deep purple-pink with blackish central patches. Length mature, 40 mm.

Food-plant: Buds and catkins of burr-oak.

The young larvæ emerge with the first warmth of spring, all the ova hatching within a short period of each other; the growth is very rapid, maturity being reached in less than a month; the pupal stage is about three weeks.

The species is very easy to raise, the critical period being just before attaining full growth, when the larvæ seem liable to intestinal troubles which are apparently more or less contagious. In our brood there was also a noticeable difficulty in properly shedding the larval skin in transforming into the pupa.

Catocala aholibah Stkr.

Ovum. Dark dirty green, surface of egg strongly granulate but without ribs; micropylar area scarcely visible as a rosette of minute hexagonal cells. Diameter, 2 mm.

Stage I. Head deep brown, prothoracic plate black; body bluish-gray with brown dorsal line, three brown lateral lines of which the middle one is most distinct; two similar subspiracular lines the upper one rather curved and much broken; abdominal segments 1-4 crossed by broken broad transverse brownish bands, heaviest laterally; tubercles large, black, with long setæ. Beneath pale with central dark blotches. Length, 6 mm.

Stage II. Head pale brown, strongly veined with black-brown, forming a line on each side arising from the mouth and curving outwards and upwards, broadest towards apex of lobes; central dark line to clypeus; body pale brown, slightly banded with brown on abdominal segments as before; a brown dorsal line broadening slightly towards rear of each segment and irregularly bordered with creamy, forming more or less distinct diamond-shaped patches as usual; two pale slightly

waved lateral lines and a third subspiracular one, much curved; tubercles large, black; slight dorsal transverse wart on the 5th abdominal segment and more prominent conical protuberance on dorsal portion of 8th; prolegs pale with black stripes. Beneath whitish with prominent black patches. Length, 10 mm.

Stage III. Head pale, strongly lined with black, apex of lobes tipped with orange behind which is a heavy black curved line; body gray-purple with distinct black tubercles which at times are orange-tipped; a prominent transverse blackish wart on 5th abdominal segment and a conical protuberance tipped by tubercle II on 8th; similar lesser prominence on the 9th; lines and stripes as in preceding stage but broader and less distinct; lateral black shading below transverse wart of 5th abdominal segment. Length, 18 mm.

Stage IV. Head pale creamy strongly lined with black in front and with apex of lobes tipped with orange behind which is heavy black marking. Body purple-brown, the 1st abdominal segment with pale creamy suffusion between and lateral to tubercles I and II, often very faint; stripes of previous stage not distinguishable but the black border lines have broken up into a series of irregular dotted lines on a more or less whitish ground, giving a general mottled appearance; tubercles orange, tipped with black and ringed at base with white, the black color often predominating; transverse wart of 5th abdominal segment black, tipped with white at apex and defined laterally by the orange tubercles II; laterally to this is more or less oblique dark suffusion; prominent hump on 8th abdominal segment tipped by large conical tubercles II, orange in front, black posteriorly. Beneath whitish with black central blotches. Length, 30 mm.

Stage V. Head pale ochreous, pitted, marbled with purplish gray with tips of lobes tinged with umber-brown, beneath which is a blackish dot and behind which on the dorsal portion of the lobe is a broad black stripe slightly curved at each end but not descending downwards below the level of the umber-brown area. Body pale liver-brown with numerous black dots encircled with white the remnant of the lines of earlier stages; tubercles coral or deep brown ringed at base with white; transverse wart of 5th abdominal segment whitish strongly marbled with black; 6th and 7th abdominal segments laterally and posteriorly slightly discolored with brownish; 8th abdominal segment with strong dorsal hump on which are situated tubercles II, large, conical, directed backwards, umber tipped with black; spiracles situated in pale area, black-rimmed; legs pink, shields of prolegs, prothoracic and anal plates ochreous; filaments white; first abdominal segment between tubercle II and spiracle slightly paler, the remains of the patch of the previous stage. Beneath white with black and brown central blotches. Length, 60 mm.

Food-plant: Buds and catkins of burr-oak.

The emergence and habits of the young larvæ coincide with those of *zoe*; in all its stages the species shows a close resemblance to *sponsa* of Europe. Ova from Truckee, Calif. and Provo, Utah gave rise to similar larvæ, the resulting imagines being also identical except that the Utah specimens were generally larger. About 1-4 of the Utah larvæ gave the form *coloradensis* Beut. which is a

mere aberration in which the primaries are distinctly paler and the brown band beyond the t. p. line more marked in consequence.

Catocala beutenmuelleri B. & McD.

Ovum. Flat, strongly ribbed; micropylar area forms a slightly raised button with central depression containing the micropyle itself; from the rim of this area 17-20 broad unbranched ribs arise, crossed at right angles by numerous fine wavy cross-ribs. Color purple with yellow ring a short distance above the base. Diameter, 1 mm.

Stage I. Head black. Body pale gray with 3 brown lateral stripes; diffuse brown patches laterally on 1st four abdominal segments with traces of a 4th brown line posterior to them; below these a 5th subspiracular line; tubercles black, small, with long setae. Beneath pale with central dark blotches. Length, 4 mm.

Stage II. Head pale gray, heavily mottled with brown except in front and with two heavy dark curved lines below apex of lobes not reaching lower than apex of clypeus; five equidistant lateral and subspiracular lines as before, the 3rd line rather waved, the lower line distinct; dark lateral abdominal patches much fainter than in preceding stage; dorsal region with two brown lines narrowing between tubercles I and spreading out towards rear of segments tending to form diamond-shaped patches of the enclosed space; traces of a centro-dorsal line between tubercles I on abdominal segments; on 5th abdominal segment a slight raised dorsal wart; on 8th abdominal a small conical projection; tubercles black with setae as before. Length, 9 mm.

Stage III. Head as before but more striate with black. Body and markings essentially as before but pale dorsal diamond-shaped patches more noticeable and the dark lines appearing more as border lines to enclosed yellowish stripes; small transverse wart on 5th abdominal segment; the rear portion of this segment and anterior portion of 6th shaded with blackish; 8th segment raised dorsally with conical reddish tubercles and a small black lunate mark posterior to these; prolegs with black stripe. Length, 15 mm.

Stage IV. Head pale, strongly marbled, apex of lobes slightly orange, below which is a small blackish curved mark; behind the apex of lobes a curved double black line extending laterally down the sides of the cheeks. Body gray, somewhat ochreous at the incisions of the first four abdominal segments; lines and stripes much as before but fainter, the former being broken up into a series of dots; tubercle on 5th abdominal segment black, prominent, with dirty brown oblique patch extending laterally downwards to base of prolegs; tubercles deep orange, those on 8th abdominal segment situated on a strong hump behind which is a curved orange mark; prolegs pale, striped with black; beneath whitish with the usual black patches.* Length, 25 mm.

Stage V. Head purplish gray marbled in the front of the lobes with darker; the two tubercles at the apex of the lobes tipped with orange with dark blackish curved mark behind the apex. Body light gray, fairly smooth, with small oblique ridges on the anterior abdominal segments extending laterally forward from tubercle II; pale dorsal stripe with diamond-shaped enlargements; remainder of body heavily marbled with black dots, representing the dark border lines of previous.

stages; a very prominent fleshy beak-like wart on 5th abdominal segment shaded with black and with black posterior markings extending obliquely downward over the anterior portion of the following segment; laterally the 5th segment is shaded with light brown extending between the prolegs on to the 6th segment; prominent conical dorsal tubercles on the 8th abdominal segment with lunate brown mark behind extending to above spiracle; filaments whitish; beneath white with central black blotches. Length, 40 mm.

Food-plant: Buds and catkins of oak.

The larvæ emerged about a week later than *zoe* and *aholibah* maturing rather more slowly than these two species; a number of the full grown larvæ refused to pupate but gradually shrivelled up and died; it is probable that better results would be obtained by isolating the larvæ in the last stage. The prominent dorsal wart on the fifth abdominal segment would place the species in the *ultronia* group. In our opinion *beutenmuelleri* will prove to be a local race of *verrilliana* but we can find no larval description of this species. We cannot agree with Hampson who makes this species and *werner* Bied. synonymous; this latter species, of which the type is in Coll. Barnes, shows much more affinity to *violenta* Edw. and we should not be surprised if it proved to be a mere aberrant form of the same; *ophelia* Hy. Edw. we have proved by breeding to be a species very distinct from *beutenmuelleri* and presumably therefore from *verrilliana*; breeding alone will show how closely it is related to *violenta* Edw.

Catocala ophelia Edw.

Orum. Hemispherical, much higher than *beutenmuelleri*; ribbed, about 20 ribs attaining the edge of the raised circular micropylar area, every second rib branching dicotomously in contradistinction to the preceding species where the ribs always remain single; color liver-brown with yellow ring near the base. Diameter, 1.2 mm.

Stage I. Head blackish; body blue-gray more or less completely banded with brown on the first four abdominal segments, tending to form lateral and dorsal blotches; tubercles black with long black setæ; geminate rather waved dorsal brown lines situated in the area between tubercles I and II and tending to separate towards rear of each segment; three lateral brown lines and two further subspiracular ones. Beneath whitish with brown central patches. Length, 6 mm.

Stage II. Head pale gray, marbled with black with inverted V shaped black mark on front of each lobe and central black dash on clypeus. Body pale yellowish gray with black tubercles and traces of lateral purplish patches of previous stage; markings as before with the addition of a centro-dorsal broken stripe, thickened slightly at intervals. Length, 11 mm.

Stage III. Head same as before. The lines on the body of the previous stage

now appear as border lines to three pale ochreous stripes; dorsal stripe broadening to the usual diamond shaped patches and with central dark line, thickening in these same patches; small dark transverse tubercle on 5th abdominal segment; dorsal protuberance on the 8th abdominal segment with large conical flesh-colored tubercles; 9th segment similar but smaller. Length, 18 mm.

Stage IV. Head pale with V mark and central dash as before; apex of lobes tinged with orange; cheeks bordered by a double black curved line. Body pale gray, the markings essentially as before but fainter, the black border-lines broken up into dots, the lateral stripes most marked between prolegs of 5th and 6th abdominal segments, the ground color being here somewhat darker; dorsal wart on 5th abdominal segment small, shaded with blackish; tubercles orange, II on the 8th abdominal segment large, extended backward and situated on a prominence. Beneath white with black central patches. Length, 30 mm.

Stage V. Head pale purple-gray, apex of lobes white, slightly lined with orange-red and purple, the white color extending down cheeks frontally in irregular lines; a black lateral border line to cheeks shaded inwardly with orange. Body deep gray, smooth, heavily dotted with black; stripes of the previous stages fairly distinct; tubercles small, brick-red, tubercle II on 8th abdominal segment large, situated on prominence, wart on 5th abdominal segment small dusky; an ochreous subspiracular stripe between prolegs of 5th and 6th abdominal segments, shaded dorsally with deep smoky gray; filaments whitish. Beneath white with the usual dark central patches. Length, 40 mm.

Food-plant: Buds and catkins of burr-oak.

The species may at once be separated from the preceding by the lack of the prominent hump on the 5th abdominal segment and the presence of an ochreous patch between prolegs of 5th and 6th abdominal segments. It coincides with *beutenmuelleri* in its general habits. The parent moth was captured at Provo, Utah.

Catocala desdemona Edw.

Ovum. Pale yellowish, very finely ribbed with numerous branching ribs, hemispherical; micropylar area slightly raised, circular.

Stage I. Head brownish; body pale gray with fairly large black tubercles and brown lateral patches on abdominal segments 1-4 tending to broaden into transverse bands; three brown lateral lines and traces of three further lines below these the upper two of which are only visible behind the lateral brown patches. Beneath pale with central brown blotches. Length, 6 mm.

Stage II. Head gray with curved black line in frontal portion of cheek curving outward toward apex of lobes; central black line on clypeus. Body gray with pale germinate dorsal stripes bordered with dark brown and tending to coalesce; two pale lateral stripes similarly bordered; a third subspiracular one; a faint brown line defines the pale ventral area; traces of the dark lateral patches still present. Length, 13 mm.

Stage III. Head pale gray slightly tipped with orange; dark W mark in frontal

portion of cheeks and dark curved lateral border to same; clypeus with central dark line. Body pale gray; dorsal and three lateral creamy stripes prominent, bordered by brown lines; 5th abdominal segment with small dorsal wart tipped with reddish at apex; from this wart a dusky lateral shade extends downward to the prolegs, crossed by the pale lateral stripes; tubercles reddish, tubercle II of 8th abdominal segment conical, with dark lunate reddish line posterior to it; prolegs striped with black. Length, 18 mm.

Stage IV. Head gray, apex of lobes tinged with orange-red; lobes strongly marbled vertically forming W mark frontally; geminate lateral black curved line and central line to clypeus. Body gray with paler creamy stripes; dorsal stripe, as usual, tending to diamond-shaped enlargements, with centro-dorsal dark line and similar colored border-line, most prominent at rear of 1st four abdominal segments; three pale lateral stripes bordered with blackish lines which tend to break up into dots; on 1st abdominal segment a dark oblique lateral shade extends forward from tubercle II toward the 3rd pair of legs; dorsal wart on 5th abdominal segment flesh-colored with diffuse darkish shade extending from it laterally to prolegs; tubercles orange; curved line behind the conical dorsal tubercles on 8th abdominal segment brownish. Beneath whitish with the usual dark blotches. Length, 20-30 mm.

Stage V. Head whitish tinged with orange in front and along sides of cheeks; pale purple gray marbling in front forming a W mark, black border stripe to cheeks laterally. Body pale to dark gray caused by numerous dark dots on a whitish ground; dorsal and lateral stripes of previous stage distinct, latter waved and irregular, the dark border lines broken up into dots, most distinct behind tubercle II on first 5 abdominal segments as lower border of the dorsal stripe and upper border of the first lateral one; on first abdominal segment an oblique pale shade running from tubercle II to beyond spiracle and bordered posteriorly slightly with dark gray; wart on 5th abdominal segment fairly large, tipped with white, with brown marbling at base, lateral to this wart an oblique brownish shade crossed by the pale stripes and with the ground color showing on a level with the spiracle as a dark gray cross-stripe; reddish lunate dorsal line on 8th abdominal segment posterior to the large conical tubercles II; tubercles orange with white base; prolegs pinkish marbled with brown; filaments white. Beneath white shaded with pink with the usual dark central blotches. Length, 50 mm.

Food-plant: Buds and catkins of burr-oak.

This species was the latest of the oak-feeders to emerge; after reaching its full size the larvæ seem to find difficulty in pupating, a number of ours dying at this stage. The larva is considerably larger and more variegated than that of either *ophelia* or *beutenmuelleri*.

Catocala pura Hlst.

Orum. Hemispherical, deep purplish-red banded with yellowish near base, ribbed, the ribs branching into two or three shortly after leaving micropylar area

which is slightly raised. Very similar to the egg of *C. faustina*. Diameter, 1.25 mm.

Stage I. Head red-brown. Body when first emerged blackish, later dirty green shaded with purplish anteriorly and posteriorly, with three pale lateral lines; tubercles small, black, with short setæ. Beneath paler with faint central dark blotches. Length, 5-6 mm.

Stage II. Head pale creamy, cheeks slightly marbled with light brown; body light brown, the three pale lines have broadened into waved stripes bordered with darker lines; a pale dorsal stripe, expanding more or less into diamond patches and with trace of centro-dorsal line; 5th abdominal segment with slight transverse black wart from sides of which an oblique black patch extends backward and downward to just above the prolegs of 6th segment; a lunate dorsal black line on 8th abdominal segment the dorsal tubercles of which are slightly raised and conical; all other tubercles very minute; prolegs pale. Length, 15 mm.

Stage III. Head creamy tinged with orange below the apices of the lobes, pale brown frontal marbling, two lateral deep brown lines on the cheeks. Body pale gray-green, having a general marbled appearance; marking essentially as in previous stage, the pale stripes however are scarcely distinguishable and the brown border lines appear prominent, giving the appearance of 7 waved lateral lines and a similar dorsal one; rear portion of 5th abdominal segment velvety-black, this color extending obliquely downwards to prolegs of 5th and 6th segments; a small dorsal wart tinged with orange situated in this black area; tubercles pale orange, tubercle II on 7th abdominal segment tinged posteriorly with black, on 8th with a black lunate dorsal mark, slightly broken in the center posterior to this tubercle. Length, 25 mm.

Stage IV. Head creamy, apical portion of lobes orange below which is pale brown marbling, cheeks with dark curved border-line. Body pale gray-white, the blackish border-lines resolved into dots giving a general marbled appearance; transverse orange wart on 5th abdominal segment with the black shading of the previous stage less pronounced, only traces of this color being visible above the prolegs; tubercles orange, tubercles II on 8th and 9th abdominal segments being situated on conical prominences, the former the larger; lunate black mark on 8th as before but unbroken; dorsal diamond patches on abdominal segments shaded with pale orange-brown. Length, 30 mm.

Stage V. Head pale gray; apical portion of lobes with rather prominent tubercle shaded broadly with orange; purplish marbling and black lateral border as before. Body round and smooth, pale whitish gray, heavily sprinkled with black dots which tend to form wavy longitudinal lines; pale dorsal diamond patches faintly visible, slightly tinged with ochreous; prominent reddish ochreous hump on 5th abdominal segment at times with traces of the black lateral shading of former stages, often entirely without this; lunate mark of 8th abdominal segment less distinct than before, tubercle II prominent, conical; legs flesh-colored; filaments grayish. Beneath white with the usual dark central patches. Length, 60 mm.

Food-plant: Poplar.

The ova start hatching soon after the first warm weather in spring the period of emergence extending over several weeks.

We were very successful with this species and secured a long series of moths; two forms were represented in about equal numbers—the typical one with black shade extending nearly the whole length of wing above inner margin and a form in which this shade was lacking, the wing being more even gray; both these forms were the offspring of a single ♀.

Catocala aspasia Stkr.

Ovum. Liver-brown, micropyle and broad irregular ring at upper part of egg pale greenish yellow; ribbed but not very strongly, the ribs dividing below micropylar area into about 30-40. Diameter, 1 mm.

Stage I. Head pale brown; body pale greenish white, semitransparent, shading slightly into reddish laterally with traces of three pale lateral lines; tubercles very minute with small setæ. Length, 5 mm.

Stage II. Head creamy, slightly marbled with pale brown; body whitish, slightly green tinted, an irregularly broadening dorsal stripe and three lateral ones are visible largely due to the pale brown linear borders; a faint trace of brownish lateral shading on 5th abdominal segment, prolegs concolorous. Beneath pale with dark central patches. Length, 12 mm.

Stage III. Much as before; head shaded slightly with pale yellow at apex of lobes; body with stripes less visible and bordering lines broken up into dots, giving a general marbled appearance; very small wart on 5th abdominal segment, slightly yellow, with still fainter traces of lateral black shading; tubercle II on rear segments slightly yellow with traces of a lunate dorsal black mark on the 8th abdominal segment as found in *pura*. Length, 20 mm.

Stage IV. Head whitish, clypeus slightly marked with pale brown, apex of lobe tinged with yellow-orange below which is brownish marbling of which a dash on a level with side of clypeus is most prominent; black border line to cheeks extending to eyes and not very clearly defined on the summit of the head. Body whitish gray with much clearer markings than before; dorsal series of pale diamond patches with central brown line; subdorsally two waved black dotted lines the upper one forming border to diamond-patches, the lower one on a level with tubercle III, most prominent toward the rear of each segment giving a distinctly blackish appearance; laterally the body surface is thickly covered with black and brown dots formed into more or less parallel lines, the enclosed spaces being slightly tinged with lemon yellow; prominent yellowish hump on 5th abdominal segment at times slightly shaded with black laterally but mostly without this; small blackish dorsal lunate mark on 8th abdominal segment; dorsal tubercles yellowish, tubercle II on rear segments not very prominent; prolegs tinged with pinkish. Beneath white. Length, 35 mm.

Stage V. Head creamy, clypeus with two vertical purple-black dashes; apex of lobe strongly tuberculate, orange; black border laterally to cheeks extending from palpi upwards, not clearly defined on summit of head; purplish marbling in front forming small patch below the orange tubercle and a vertical dash opposite clypeus. Body varying from pale ochreous to pale brown, sprinkled with deeper

colored dots, usually with subdorsal blackish band formed of numerous spots defining the pale diamond shaped patches, most accentuated behind tubercle II; a similar but less distinct spiracular band; tubercles yellow-ochre, small; wart on 5th abdominal segment not prominent, tinged with ochreous; vague traces of a black dorsal lunate mark on 8th abdominal segment; tubercle II on this segment not much larger than on preceding segment; legs and prolegs pale tinged with pinkish; spiracles ochreous ringed with black, filaments pale. Beneath whitish with the ordinary black blotches. Length, 45 mm.

Food-plant: Poplar.

The larva emerges somewhat later than *pura*; we brought a number of larvæ to maturity but they all failed to pupate and gradually shrivelled and died. Strecker's *aspasia* was described from Lower California and we are in doubt whether the name will apply to the form found in Utah and Colorado which commonly goes under the name *aspasia*. The larvæ in Stage III show great similarity with the final stage of *pura*, but in their maturity apparently approach closest to *parta*.

Catocala faustina Stkr.

Ovum. Echinus-shaped; deep purple-brown with blotches of pale greenish apically and a narrow central band of similar color; micropylar area arising from slight depression at apex of egg, irregularly circular, formed of minute cells surrounded by ring of single larger cells; remainder of surface with longitudinal ribs of which 17-20 attain edge of micropylar area, branching immediately below it either once or twice and forming 35-40 ribs near base of egg; these are crossed by minute transverse ribbing. Diameter, 1 mm.

Stage I. Head pale brown, mouth parts whitish. Body smooth, pale gray-green shading into purplish laterally with 8 pale waved lateral lines; prothorax, anal plates and plates on sides of prolegs gray-brown; tubercles minute black with small setæ. Beneath pale with the usual dark central blotches. Length, 5 mm.

Stage II. Head red-brown, paler towards front, mottled. Body smooth pale greenish brown, paler than in preceding stage, shading laterally into purplish, this color especially marked above prolegs forming more or less evident blotches; three pale lateral lines as before. Tubercles small, black, larger posteriorly. In later stage of growth a pale irregular dorsal band with diamond patches is visible and there are traces of a transverse reddish wart on 5th abdominal segment. Length 10 mm.

Stage III. Head pale in front, cheeks mottled with brownish with blackish curved lateral line. Body light-brown, pale dorsal irregular band bordered by dark lines and with the usual diamond-shaped enlargements; the three pale lines of earlier stages have broadened into irregular pale reddish bands, defined and bordered by dark lines; a transverse black wart across the rear of 5th abdominal

segment with slight central reddish portion; lateral black shading on 5th and 6th abdominal segments extending down over prolegs; a black lunate mark on rear of 8th segment dorsally; tubercles red-brown. Beneath whitish with black patches. Length, 20 mm.

Stage IV. Head pale, apex of lobes orange, this color extending downward to the region of the ocelli, the whole frontal area bordered by an encircling black band. Body smooth, slender, pale purple-brown with orange tubercles of which II is the largest, especially on the rear segments; dorsal stripe of previous stage shows strong central brown marbling; the lateral stripes are more or less lost in the brown marbling which is responsible for the general body-color, traces of the defining darker lines may be found in longitudinal rows of dark dots; a prominent pale orange transverse wart with brown basal shading on 5th abdominal segment; laterad to this orange brown shading extends obliquely backward over rear portion of 5th and front portion of 6th segments; prolegs pale ochreous, shaded with brown on the contiguous sides; claspers bordered inwardly with blackish; lunate mark on 8th abdominal segment orange-brown bordered posteriorly with blackish; tubercles prominently orange; spiracles situated in a pale area, black rimmed. Length, 35 mm.

Stage V. Very similar to the preceding stage. Color pale brown. The lateral oblique patch of brown on 5th and 6th abdominal segments has almost disappeared, when present it is a pale suffused brown, scarcely deeper than the ground-color, crossed by slightly darker shade-lines; filaments whitish. Length, 55 mm.

Food-plant: Willow.

We received a large number of ova laid by typical *faustina* and the forms *diantha*, *verecunda* and *zillah*. The species seems quite difficult to breed and we had success only with those larvæ which hatched earliest and were fed on willow-catkins; the parent of these was a ♀ *diantha* and the resulting progeny was about equally divided between *diantha* and *verecunda*; larvæ of the other forms attained maturity in numbers but died before pupation; we could see nothing in the larvæ to warrant the supposition that *faustina* is distinct from *verecunda* as a species; the eggs hatch over a very extended period and when the first imagines appeared in June we still had young larvæ in the first stage.

Catocala californica Edw.

Orum. Not distinguishable from that of *C. faustina*, deep purple-brown blotched apically with yellowish and with a yellowish central band.

Stage I. Head pale brown; body dark greenish with three pale lateral stripes; scarcely to be distinguished from that of *faustina*. Length, 5 mm.

Stage II. Head pale, very strongly marked with black. Body greenish-black, deepening in color posteriorly, with pale broad irregularly edged dorsal stripe and three pale waved lateral lines; small black transverse wart on 5th abdominal

segment almost hidden in the ground-color; tubercles small, black; prolegs pale. Beneath pale with the usual central blotches. Length, 11 mm.

Stage III. Head pale, lobes tipped with orange apically, marbled with brown in front and bordered by a deep brown lateral line. Body pale greenish-brown, paler dorsally; dorsal stripe with central dark line; three lateral pale waved stripes bordered with dark brown; tubercles more or less orange; transverse wart of 5th abdominal segment mostly velvety-black, tipped with orange, with strong lateral and posterior black shading extending down over prolegs of 5th and 6th segments; tubercles II of 8th abdominal segment conical with black lunate mark posterior to them. Length, 18 mm.

Stage IV. Head with the apical orange shading more extended, front of lobes marbled with pale brown with strong lateral black encircling band. Body pale purplish-gray; a rather vague pale dorsal stripe with diamond-shaped enlargements and central dark line; the three lateral stripes indistinct with the border lines broken up into a series of dots; tubercles orange, tubercle II being more prominent than in *faustina*; a prominent transverse wart on 5th abdominal segment, orange, blackish at base, with black-brown shading extending obliquely laterally as far as the prolegs, much more distinct than in *faustina*, 8th abdominal segment with conical tubercles dorsally and lunate black-brown mark as before. Length, 26 mm.

Stage V. Head purplish in front, marbled with paler, with diffuse orange shading apically and broad black encircling line laterally extending downward to mouth parts; clypeus outlined basally with black with blackish central mark. Body purplish-brown heavily mottled with black-brown dots; paler dorsal stripe with diamond patches as before; three lateral pale stripes more or less traceable; tubercles reddish orange, paler laterally; tubercle II prominent, marked posteriorly with black especially on 5th and 7th abdominal segments; prominent wart on 5th abdominal segment, reddish orange, marbled with brown; brown lateral oblique patch as before, crossed by a purple-brown spiracular stripe, above which is some diffuse purplish shading and below which a purplish line extending down over the 3rd and 4th pairs of prolegs; lunate black dorsal mark on 8th abdominal segment usually distinct, extending laterally to spiracles, these latter ochreous, black rimmed; legs and prolegs purplish with ochreous shading, filaments whitish. Beneath whitish tinged with pink with the usual central blotches. Length, 60 mm.

Food-plant: Willow.

The larvæ are very closely allied to those of *faustina* but may be distinguished in early stages by the darker coloration and in the final stage by the much greater prominence of the lateral dark patch on 5th abdominal segment. We were not very successful with the brood, only bringing a few to the imaginal state; these all showed the prominent waved white subterminal line and some white patches in the cell.

Catocala irene Behr.

Ovum. Similar to that of *C. californica* and *faustina*.

Stage I. Scarcely to be distinguished from *faustina*; head pale red-brown; body greenish-gray shading into purplish laterally with three pale lines of ground color. Length, 5 mm.

Stage II. Head whitish, marbled with blackish stripes, with slight tinge of orange apically. Body pale gray-green, laterally greenish-black with three pale waved stripes; a faint dorsal stripe with diamond-shaped enlargements. Length, 11 mm.

Stage III. Head pale with brown marbling, shaded with orange at apex and with black lateral border-lines not meeting dorsally. Body light olive-brown with pale dorsal and lateral stripes as before bordered with deep brown, the lower border of stripe II and the upper one of III especially prominent; transverse wart on 5th abdominal segment reddish with ochreous apex; below the wart a black-brown lateral shade broken by the pale stripes, deepest in color above stripe III and tending to extend along its dorsal margin towards anal segment; dorsal tubercles orange, larger and conical on 8th abdominal segment with slight black lunate marks behind them not meeting dorsally. Length, 17 mm.

Food-plant: Willow.

We were unsuccessful in bringing the larvæ to maturity. They are evidently also allied closely to *faustina*.

THE DISTRIBUTION OF SOME SPECIES OF DROSOPHILA.

BY CHARLES W. JOHNSON,

Boston Society of Natural History, Boston, Mass.

In making a careful faunal survey of any given area, covering a number of years, the gradual or sudden appearance of a species common in other sections, is often of greater importance from the standpoint of geographical distribution than the capture of a number of rare species, often widely distributed, but of whose life history or of the factors governing their distribution little is known.

During the early fall, while experimenting with various species of fungi in an effort to breed some *Platypezidæ*, my attention was called to several dark colored flies which alighted repeatedly on the netting of many of the jars containing decayed fungi. On capturing several of these I was surprised to see *Drosophila repleta* Woll. (*D. punctata* Loew), the first I had seen in Boston. I had

taken several specimens of this Southern species in Philadelphia, in 1898, had received it from Providence, R. I., in 1904 and from Fall River, Mass., in 1905. Recently Dr. E. P. Felt recorded the species as having been taken in New York City and also at Albany in September and October, 1908.

Another species which appeared later (October 15–20) in large numbers in the same jars of fungi, was *D. busckii* Coq., a species described from the District of Columbia, West Virginia and Illinois in 1901. In 1908 Mr. Wm. Reiff obtained this species from his breeding cages at Forest Hills, Mass., and in 1912, Mr. P. W. Whiting also obtained it at the same locality on decayed meat, while breeding *Lucilia*.

It seems hardly possible that these social flies could have escaped detection if they had been here in numbers for any length of time, nor is it likely that they have been introduced suddenly by commerce, although the fruit trade may have aided in the wide distribution of *D. repleta* throughout the United States, as recorded by Mr. Frederick Knab in *Psyche* Vol. XIX, June, 1912.

The corresponding distribution of *D. repleta* and *D. melanogaster* Meig. (*D. ampelophila* Loew) and the fact that in America both were first described from Cuba, seem to point conclusively to similar lines of dispersal. In 1862, Loew described *D. ampelophila* and in a note says: "*Drosophila ampelophila* is very frequent in the Southern regions of Europe, nor is it entirely wanting to middle Europe; it also inhabits the Southern parts of Africa." [Translation.]

Meigen in 1830 had described the form with blackish abdomen from Europe as *D. melanogaster* and the same form was described by Zetterstedt in 1847 as *D. nigriventris*. In 1875, Rondani described the yellow form from Italy as *D. uvarum*.

From the time of Loew's description in 1862 until about 1879, there seems to be no record in America bearing positively on this species. Then a number of articles were published indicating that their appearance in great numbers was evidently not a common occurrence. In the *Canadian Entomologist*, Vol. 14, p. 101, 1882, G. G. Bowles of Montreal says: "In August of 1879, I met with a small dipterous fly, *Drosophila ampelophila* Loew, in considerable numbers." In the same *Journal*, page 138, 1882, Dr. W. S. Williston says: "In the Autumn of 1879, I bred and recognized

numerous specimens of *Drosophila ampelophila* Loew, at New Haven, from decaying pears, and labelled specimens bearing date of October 30. Since then I have observed them in August, September and October in the greatest abundance in Massachusetts and Connecticut." After quoting the above note by Loew on its distribution he says: "The question is an interesting one: In which continent is it a native?"

Lintner, in his first annual report, 1882, page 216, says, in referring to some small flies that were sent to him, "They proved to be identical with numerous specimens of *Drosophila ampelophila* in my collection, having the memorandum of "bred from a jar of pickled plums, September, 1875." Comstock, in the Report of the Department of Agriculture 1881-1882, describes and figures its life history.

The question to be considered now is, did this species occur in the Northern States during Say's, Harris' or Fitch's time, or has it worked northward since then? Say might have overlooked it, but for Harris, and especially Fitch—who described so many minute diptera, to have entirely ignored this species, seems improbable.

To return to *D. repleta* whose dispersal throughout the United States is so fully recorded. This was described by Loew from Cuba in 1862 as *D. punctulata*. It had, however, been previously described from Madeira by Wollaston in 1858. In 1886, Mik described the same species as *D. aspersa* from Vienna, Austria and Ashanti, W. Africa. The more gradual and recent dispersal of *D. repleta* would indicate that it was not indigenous to America and that it undoubtedly appeared first in the West Indies. There is no evidence to dispute the fact that *D. melanogaster* might also have appeared first in the West Indies and being more prolific, has spread with greater rapidity.

I think we can thus reasonably consider the Eastern Continent as the original habitat of the two species and that they have been introduced either by vessels sailing from Southern Europe during the Spanish régime or from Western Africa during the slave trade. There is another fly that is supposed to have been introduced in this manner. Osten Sacken, in describing *Borborus venalicus* (Cat. of Diptera, p. 263, 1878), from Cuba, says: "Dr. Loew informs me that this is an African species; and as I found it abun-

dantly in Cuba, it seems probable that it was brought over in slave ships." This species has also spread northward into Florida and Bermuda and southward to Brazil.

NOTE ON TWO PREOCCUPIED MUSCID NAMES.

In the April issue of *Psyche* I published a synopsis of the Sapromyzidæ in which on page 58 was described a new genus of Sciomyzidæ under the name *Poecilomyia*. Hendel (*Genera Insectorum*, Richardiinæ, p. 24, 1911), has previously used this name, hence I propose to change it to *Poecilographa*. In the same paper, on page 73, I described a *Minettia annulata*, overlooking Becker's *Lauzania annulata* (*Ztschr. Hym. Dipt.*, 1907, 383). In as much as the present tendency is to consider *Minettia* as a subgenus of *Lauzania* the preoccupied name may be changed to *annularis*.

A. L. MELANDER.

BOOK REVIEW.

Seitz, Adalbert. *The Macrolepidoptera of the World*. To be completed in 16 volumes containing about 485 parts, of which two complete volumes and numerous parts have been issued. Stuttgart, Verlag des Seitzschen Werkes (Alfred Kernen) 1906.

This elaborate compendium of the larger Lepidoptera, undertaken by Professor Seitz in 1906, has now reached the stage that its completion within a reasonable time seems to be assured. A large number of fascicles have been issued by Seitz and his various collaborators, who include, Aurivillius Bartel, Eiffinger, Fruhstorfer, Grünberg, Haensch, Janet, Jordan, Mabille, Pfitzner, Prout, Röber, Rothschild, Standfuss, South, Strand, Warren and Weymer.

The main feature of the work is a large series of beautifully executed, colored plates, which according to estimate will number about one thousand in the completed set. All which the reviewer has seen are of very exceptional quality in spite of the low price at which they are sold. The letter-press includes descriptions of genera and higher groups as well as of species and these seem on the whole to be fairly complete, although occasionally the specific descriptions drift into a running commentary on the illustrations. Considering, however, the enormous mass of material to be dealt with, the authors are to be congratulated on avoiding this latter condition to a very great extent. Taken together, the text and figures should make it a comparatively simple matter for any one to identify a large proportion of the species that are described and figured. To facilitate this process, the faunæ of the different zoölogical regions have been grouped into four independent series dealing with the Palearctic, American, Indo-australian and African faunæ respectively. Each is to be complete in itself as a set of four volumes and an additional 17th volume to contain general matter on structure, biology and distribution is promised.

Lepidopterists as well as amateur collectors throughout the world will be very fortunate to have such a generally complete cyclopædic account of the larger butterflies and moths.

C. T. B.

EXCHANGE COLUMN.

Wanted, in exchange or for cash, North American Catocala.—Rudolph C. B. Bartsch, 46 Guernsey Street, Roslindale, Mass.

Empididæ desired from any part of the world.—A. L. Melander, Bussey Institution, Forest Hills, Mass.

Will name and return species in certain families of Coleoptera. Buprestidæ especially desired.—C. A. Frost, 26 Pond Street, South Framingham, Mass.

Wanted. Insects from ant-nests, with specimens of the ants, from any part of the world. Will give Coleoptera, Diptera and Hymenoptera from the Western United States.—W. M. Mann, Bussey Institution, Forest Hills, Mass.

Will exchange for Geometridæ from any section of North America, or identify material for privilege of retaining examples.—L. W. Swett, 501 Washington Street, Room 44, Boston, Mass.

Will exchange insects of various orders for Parasitic Hymenoptera from any part of the world.—C. T. Brues, Bussey Institution, Forest Hills, Mass.

Wanted, for cash or exchange, living material of *Lucilia* from the Southern States; also living material of *Cynomia mortuorum* from Europe and any other species of *Cynomia* except *Cadaverina*. Will give directions for shipment.—P. W. Whiting, Bussey Institution, Forest Hills, Mass.

Carabus chamissonis and other rare Coleoptera for Dytisidæ not in my collection.—F. W. Dodge, Melrose Highlands, Mass.

Wanted. Ants from all parts of the world.—W. M. Wheeler, Bussey Institution, Forest Hills, Mass.

I pay cash or give American and exotic insects in exchange for fertile eggs of *Catocala* spp., living *Cataocla* ♀ ♀ (captured specimens only), hibernating pupæ and larvæ of any other group of Lepidoptera.—William Reiff, 366 Arborway, Jamaica Plain, Boston, Mass.

Numbers of American Museum Journal Desired. Vol. III, No. 4. Vol. V, Nos. 1, 2 (including Guide leaflet 18), and 3.—Nathaniel T. Kidder, Milton, Mass.

Florida insects of all orders, also Fish, Batrachians, Reptiles, Shells and Marine Invertebrates sold by A. G. Reynolds, Gulfport, Florida.

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